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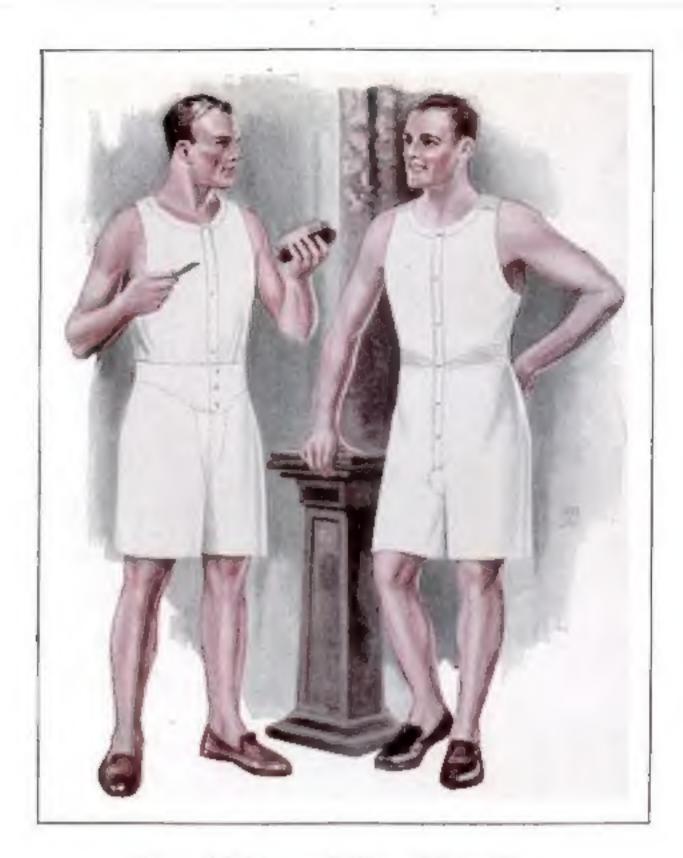
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HEAR ELECTRONS JUMP!

Do electrons jump? We talk about quadrillions of them per second leaping across from the filament of the plate of a Radiotron, when you are listening to a lecture. But these particles are so tiny that no microscope could make them visible—not even a thousand of them clustered together!

They cannot be seen. But in one of the Radiotron laboratories there is an interesting device with which they can be heard. A delicate amplifying system and a loudspeaker do for the ear what the micro-scope cannot do for the eye—they neveal the actual existence of the electron. You hear it hit the chamber.

This device is but one of many fascinating machines built in the laboratories of "pure science" where research carries forward out knowledge of the vacuum tube and its action. When you buy an RCA Radiocron, you have the benefit of this research, in the fine performance of the tube in your set.

There is a Radiocron for every purpose Look for the RCA mark to be sure it is genuine.



RADIO CORPORATION OF AMERICA New York



The new radio is clearer try this improvement on your old set

Most people want radio music loud enough to fill a room. But on many sets, this volume of tone cannot get through the last audio stage without getting badly distorted. But you don't hear this blurred music so much today.

Since RCA developed the power Radiotrons, they've been adapted into new sets. Make the same change in your old set. Let the big volume through clear and true-toned—without distortion. Put in one power Radiotron in the last stage, and clear up the tone!

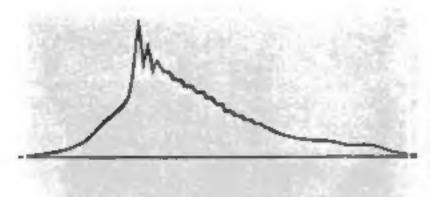
- Jane

Bring your storage buttery as up-to-date with a poure Experience unity or the 12 or the 12 or detector named has unitarity at ap-to-date with a power named has the last appropriate with a power named has for all-round quality.

RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA

The first picture of that knock

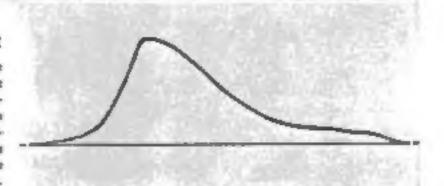


This is the "knock" in your motor

This shows photographically what occurs in the engine cylinder as carbon forws, when straight gasoline is used. The increased heat and pressure created by the curbon cause the gasoline to explode too quickly, with the result that there is an accumulation of high pressure hear waves which strike against the cylinder walls so violently as to produce an audible metallic sound. The bumps in the line are that "knock."

This is how "ETHYL" knocks it out

And this shows photographically what goes on in the same cylinder under the same conditions when straight gasoline is trasted with "ETHYL" fluid. Note the absence of "knock-bumpe"; the eventual of the pressure changes. The "ETHYL" fluid has neutralized the heating qualities of the curbon deposits and by maintaining the normal combustion rate of gasoline has turned the lacreased pressure due to carbon facts factorised power.



THESE PHOTOGRAPHS were made possible by a special instrument invented by General Motors Research Laboratories to find out what goes on in an automobile engine's cylinder when "knocking" occurs.

That invention led to the discovery that what you may call an "engine knock" or a "spark knock" is in reality a fuel knock. It is due to the tendency of a straight gasoline to explode too quickly as carbon forms and increases temperature and compression (pressure).

Having determined the character of "knocking," General Motors developed "ETHYL" fluid, a patented chemical compound which when added in very small quantities to straight gasoline forms Ethyl Gasoline, the most effective "anti-knock" fuel yet known.

Ethyl Gasoline transforms carbon deposits from a liability into an asset. It produces more power on hills and heavy roads. It gives a faster "pick-up," reduces gearshifting, lessens vibration and engine wear and tear; and saves the trouble and expense of carbon removal.

Ethyl Gasoline has increased the motoring satisfaction of hundreds of thousands of car drivers. It is destined to play a still more important part in the automobile history of the future. TRY IT.

ETHYL GASOLINE CORPORATION 25 Broadway, New York ETHYL GASOLINE is now generally available throughout the United States and Canada through the following oil companies, lineased to mix" ETHYL" fluid with geneline. The "ETHYL" trademark on the pump is your protection.

Associated Oil Company Atlantic Refining Co. r Beacon Oil Company / Continental Oil Company / Humble Oil & Refining Co. . Imperial Oil Limited (Canada) + Pennzoit Company . Refiners Oil Company . Spears & Riddle Co. . Spakene Oil & Refining Co. r Standard Oil Company (Indiana) + Stendard Oil Company (Kentucky) Standard Oil Company of Louisiana Standard Oil Co. (Neb.) Standard Oil Company (N. J.) Sterling Oil Company . Union Oil Company of California . Walhurn Petroleum Co. r Waverly Oil Works

ETHYL GASOLINE



A Four Square Financial Plan for a Young Married Couple

By WALLACE AMES, Financial Editor

HE Financial Department's mail at the POPULAR SCIENCE MONTHLY office contains many letters relating to interesting financial plans and problems such as tveryone confronts. We are yielding to the temptation to publish one of these letters together with our reply as we believe the subject will stimulate the thoughts of every reader who is seeking a sound program for his personal finances.

Because of the personal nature of the following letter the identity of the writer has been purposely deleted.

Mr. Wallace Ames,
Financial Editor,
Popular Science Monthly,
New York City.
Dear Mr. Ames,

My wife and I would appreciate your advice and suggestions in our financial situation. In order that you may be familiar with our case it is necessary to give you some personal facts.

I am thirty-two years old and have been married three years. Until now my salary has been \$6,000 a year, but I have just been advanced to a higher position at a salary of \$8,000 with an opportunity of an annual bonus of \$500 to \$1,000.

In the past, both before and since I was married I notice that soon after every increase in income my expenses grew up to it so that to date I have not accomplished much of anything towards future financial independence.

We have been getting along comfortably on \$6,000 and my wife and I are very anxious to make this new increase in income be the beginning of real worthwhile financial progress.

THUS far we have laid by \$1,000 and I am carrying \$10,000 life insurance. Without stinting we can save and invest \$1,000 to \$2,500 a year from now on. If not asking too much, would you be good enough to write me suggesting the plan or program that you think a young married couple should follow under the circumstances I have outlined.

Here is Mr. Ames' reply to the above letter:

It is a pleasure to assist you in the formation of a sound getting ahead program. Judging by the information

contained in your letter you are ideally situated to carry out what we term the Four-Square Financial Plan.

The four parts of this plan are the ollowing:

 Adequate savings bank balance for emergencies;

 Adequate life insurance protection;

3. Home ownership;

 Sound securities for independent income.

A Service for Readers

THIS Financial Department is to help readers in the establishment of proper financial programs at the beginning of their business careers; it assists those who have accumulated money in the proper investment of it.

The Editor of this Department is an authority on investment matters. He is ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

funds and proper plans of saving.
Address your inquiries to
Wallace Ames, Financial Editor,
POPULAR SCIENCE MONTHLY,
250 Fourth Avenue, New York.
While investments obviously
cannot be guaranteed by the
Publisher, every effort will be
made to insure that only advertisements of absolutely reliable companies are accepted.

In the first place we suggest that you leave the \$1,000 you now have in the savings bank where it will draw 4% compound interest. This will give you available cash for any ordinary emergency or special purpose.

Next in logical order is life insurance. Your present insurance line, amounting to \$10,000 would at \$% yield your wife an annual income of \$500. This is not adequate. If you increase your insurance to \$50,000 your wife would have an income (at \$%) of \$2,500 in the event of your death. While this sum is less than each of you now spend to live we would consider it adequate protection.

At age 32 ordinary life insurance costs about \$16.25 a thousand (dividends deducted) or \$650 a year for

\$40,000 additional insurance. We believe you would find it convenient to take out several policies so arranged that you could pay about \$54 each month in premiums instead of having larger sums come due less often.

After paying insurance premiums you have approximately \$1,800 a year for investment. Of course you should anticipate owning your home. If you plan on one valued at \$15,000 to \$18,000 it would require a cash investment of say \$9,000 in addition to the mortgage. With this in view invest \$150 a month for five years in securities maturing in five years. You should then have, including interest earned, about \$10,000 to \$10,500. This finances your home purchase and leaves a starter for a long-term security buying program.

THE fourth step in your four-square financial program is to acquire sound securities for permanent independent income. For this purpose you simply continue to invest \$1,800 annually (\$150 a month) the same as you trust did to buy your home. If you devote the first five years to home buying there remain thirteen years before you are lifty. Let us see what you can accumulate by that time.

According to the table published in the booklet of one investment banker \$150 a month invested in their 63/% bonds builds a total worth of \$36,595 in thirteen years, of which sum \$13,195 is interest. Another bond house publishes a table of results of systematic investing which shows that \$150 a month invested in bonds yielding an average of 6% will amount to \$43,567 in fifteen years. (The figures in this table are in five-year periods only so we cannot ascertain the exact accumulation in thirteen years.)

Of course it is impractical to estimate down to the dollar how much you may accumulate over a period of years. But it is safe to approximate that in thirteen years, or by the time you reach fifty years of age, you may own \$36,-000 to \$37,000 of bonds.

On the basis of the general plan outlined we would estimate your financial worth at fifty years of age as follows:

Retire in 15 years

on your Present living Budget

Follow the definite plan given in this book, and your financial independence is won.

The plan works just as sarely, whether you are now earning \$1,000 or \$100,000 a year.

The way is certain—each step plainly indicated and absolutely safe—independent of luck, business genius or speculation.

Every fact has been harvested out of the 46 years' experience of Cochran & McCluer in the first mortgage investment banking business.

The plan is so simple, anyone can understand it—so definite anyone can followit—and socertain, no one can fail.

In addition to the Financial Independence Plan and the unique budget schedule, the book gives suggestions that enable you to enjoy more of the good things of life, both while building your independent fortune and after you have attained it.

We invite the most skeptical to read this plain, stealghtforward, interesting book.

Phone, call or send coupon. We employ no salesmen, therefore none will

mail	Crichran & McCluer Cn. 40 N. Dearborn St., Chicago, III. Please send no. without obligation, jour book. "Rehind The Hotoes Where Houde Are Made."
His	Name
Him	Street
	City State

Cochran & McCluer Co.

46 North Dearborn Street

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Construction of Small Alternating Current Motors

By PROF. A. E. WATSON Brown University

This book contains complete instructions for building small alternating current motors in several sizes. The designs will be found in barmony with those of the very best manufacturers and they can be worked out by the amateur for making useful instruments.

Fully Illustrated.

Price, \$1.50

POPULAR SCIENCE MONTHLY
250 Fourth Ave. New York City

A Four Square Financial Plan

Savings bank balance including accumulated interest.....\$ 1,000

Total financial worth \$60,000

We strongly recommend that you start the four-square financial plan and adhere to it as closely as possible.

To Help You Get Ahead

THE Booklets listed below will help every family in laying out a financial plan. They will be sent on request.

How to Build an Independent Income [1917] Edition — Describes a plan for buying 6 [45]. First Mortgage Bonds by payments of \$10 or more a month, and shows the results that may be accomplished by systematic investment. Address: The F. H. Smith Company, Smith Building, Washington, D. C. Ask for Booklet 75.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the hunker who offers it. Address: Fidelity Bond & Mortgage Co. 1188 New York Life Building, Chicago, Ill.

Behind the Scenes where Bonds Are Made tells how you can retire in fifteen years and have an income equal to your present living budget. This booklet can be secured by writing to Cochran and McCloer Company, 46 North Dearborn Street, Chicago, III.



Assurance

Life is full of promise when hearts are young. A good time to insure fulfillment by insugurating a definite savings plan.

Fidelity's booklet, "The House Behind the Bonds," will belp you. It explains the importance of buying first mortgage investments secured by the right hind and amount of physical property; and how the reputation of the issuing bond house contributes to this safeguard.

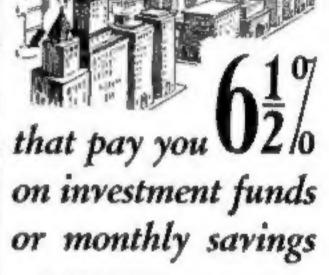
Whether or not you contemplate purchase of Fidelity 61/2% Guaranteed Bonds, send for this booklet. No charge and no obligation.

FIDELITY BOND MORTGAGE (O.)

ero Chemical Bidg. Sc. Lnuis v.88 New York Life Bidg. Chicago 378 Colorado Nat T Bank Bidg. Denver

FIDELLTY GUARANTEES EVERY BOND

SAFE BONDS in Safe Cities ---



MODERN, income-producing property offers exceptional security to the first mortgage investor, because the income from the property provides a constant source of funds from which interest payments can be made promptly, and a substantial part of the principal paid off each year.

It is such security as this, located in important and thriving cities of the United States—cities where rental demands are well established and where real estate values and economic conditions are sound—that protects your investments in SMITH BONDS.

Now you can get a 61/2% return, with this strong security, and with safeguards that have resulted in our record of

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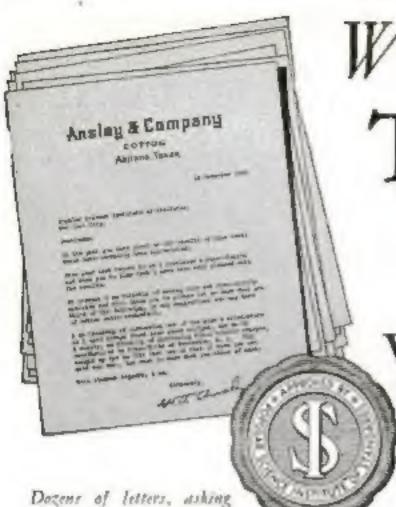
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What
THOUSANDS

DID—

Who Were Buying Radio, Tools and Oil Burners

O AID readers in their buying problems, to determine
that only reliable products
were being advertised and to
make Popular Science Monthly a
still better magazine—these were the
three aims the publishers had in mind
in establishing the Popular Science

what equipment is approved,

come to the Institute daily

Institute of Standards.

The Institute has been functioning three years now and these aims have been realized to an even greater extent than was expected. The fact that eleven thousand readers have come to the Popular Science Institute of Standards for advice in buying radio, tool and oil burning equipment shows that there was a real need for such a buying service as the Institute offers. Products offered for advertising have been carefully investigated with the result that advertising space has been refused to numerous concerns manufacturing equipment that failed to measure up to the rigorous standards of the Institute of Standards. And, in contacts with readers, comments are repeatedly made on the improvement and raised standard of the magazine.

At the time that the Institute was established, it was recognized that a staff of experts and the expenditure of considerable time, ingenuity and money would be necessary. Under the direction of Professor Collins P. Bliss, who is head of the mechanical engineering department and director of testing laboratories at New York University, a group of engineering and electrical experts have been constantly working. Their first problem was to devise tests and testing equipment. Practically nothing had been

done along the lines of radio and tool testing previously, no apparatus had been de-

signed with which to make such tests, nor had standards of efficiency been established. Ingenious and thorough test methods were worked out which have made it possible for the Institute to definitely separate reliable, dependable equipment from equipment of questionable worth. All this required more thought, labor and apparatus than was first estimated, but it has enabled the Popular Science Institute to answer definitely the question: "Will the tool or radio equipment give satisfactory service to our readers?"

In the case of oil burners, just as definite information has been obtained in a different manner. It was found that it was not feasible nor practical to test this type of equipment. To get authoritative information on the subject, it was necessary to question home owners who had been using an oil burner for one or more years. So

Populat Science Monthly sent investigators into 1500 homes all over the country. Then 1500 other oil burner owners were questioned by mail. The combined results were tabulated and chartered, giving a clear picture of the findings.

ture of the findings.

As a result, the Popular Science Institute of Standards knows more about domestic oil burners on the market and the degree of satisfaction the different makes are giving than any other organization in the country. Not only Popular Science readers, but hundreds of other prospective oil burner owners who have heard of the survey, have made their selection of a burner on the Institute's advice. There is no charge for such service but information must be given on the size of the house to be heated, its heating system, annual coal consumption, and as to whether gas and electricity are installed. Such information is essential if the Institute is to advise authoritatively.

AS TO the principles by which the Institute is governed, it must, and does, present only the actual facts discovered. It is for this reason that its findings are entirely unbiased and have no relation whatever to the advertising side of the radio, tool and oil burning industries in connection with Popular Science Montaly. The Institute of Standards approves on the evidence presented by its tests and investigations and those are made as extensive as is necessary to bring out the truth regarding a product.

The Institute's advice is at the disposal of every reader who is buying radio, tool or oil burning equipment. For lists of such products that are approved, and for other information, address the Popular Science Institute of Standards, 250 Fourth Ave., New York, N. Y.

Carrol tel Island

Popular Science Monthly GUARANTEE

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Scresce Montrell guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Scresce Montrell may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Scresce Montrell. The Popularies



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Frees Engineers have effected substantial economy for manufacturers in every line of industry by applying the Tycor "Sixth Sense." Whatever your problem in the indicating, recording or controlling of heat, there is a Hear Instrument to serve you. Write us for literature on any instrument, or type of instrument, and it will be sent promptly. Or, if you prefer, our engineers will consult with you on the application of the Few Suth Sense in your plant.



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Tecco St. Agencie it operate. Profest. Frank i mara distante Theory Lover -Len dealer with from firm to some

Write for Bulletin

SENSE Temperature Instruments Atlast Dependable "B" and "C" Power

Ample Voltage—Self-Adjusting—Quiet

After two years of intensive development, Grebe has produced a power unit that is:

Durable—Designed and bank for long, rehable service by a company that has made superior radio apparatus for over seventees years. Its amp' power reserve brings out the best tones in your sat. C" voltages automatically agus ed. for changes in B voltages.

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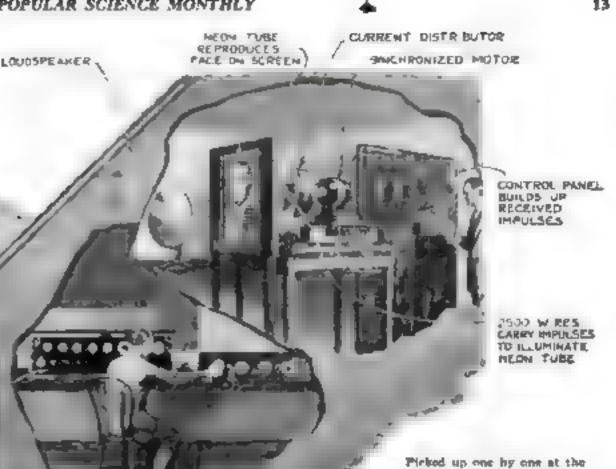
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"Built for service ~ not to a price"

ANTENNA



third passes below the second, and so on until the entire face has been scanned by the light beam in fifty parallel lines. The procedure is repeated again and again in a succession of pictures. Meanwhile the photo-electric cell is recording every variation in light and shildow in terms of electric current

SENSIFIVE RADIO RECEIVER PASSES

AMPLIFIED SWHALS

TO CONT MOL PANEL

Of course, you cannot see the moving bearn of light, for, you remember, it scaus the entire face once every eighteenth of a second. It moves so swiftly that it appears as if the face were bathed in a continuous flood of right. Yet the electric eya follows every move.

The electric current which bears the record of what its eve sees is, however, top feeble to do the work required of it So it passes through vacuum tube amplifiers, where it is magnified 5,000,000,000, OBLOOD times. Then, from the autenmaof station SNN, the magnified impulses rate out into apace on the back of a radio currier wave—an electrical "flying per

ture" of the comedian there in the studio.

RECEIVING STATION

Futer, now, another room, miles away, where these purture impulses are received. You will observe that they are reproduced to one of two different ways. If only one midwidum as footing in he sits at a cabinet containing a small, translicent sized measuring about two by three mehes. On the screen the annuated face of the comedian is registered clearly and sharply, while his voice is brard from a radio loud-peaker. But behind the little screen astonishing things are happening

Reaching the receiving antenna, the perture impulses are perked up and amplified much as in ordinary radio reception Then they are led to a tube filled with neon gas and containing two electrodes. As the current lemps across the electrodes, each impulse causes the gus to glow. This flash of light is strong or weak, according

> to the light or shadow of the particular fragment of the face to which the electrical impulse corresponds.

> Hetween the neon light and the serven us a account revolving perforsted disk, an exact diparente of the disk at 3 \ and transl to run at precisely the same speed. Through the perforations each surressive fragment of light is made to land in its appointed place on the screen and at precisely the right time to play its rele in reproducing the original face.

> If a number of persons are to view the image. the screen is much larger. measuring perhaps two by three feet, and consists of a very long neon tube folded back and forth to form a large

rectangular grid or acceed. The tube is divided into 2500 little sections, ar ranged in fifty parallel lines of fifty sections each, each section corresponding to one of the fragments of the face scanned by the photo-electric cell in the transm thing station.

conciving and, the electrical

impulses are reconverted into hight waves and thrown on the screen on shown above, copen-

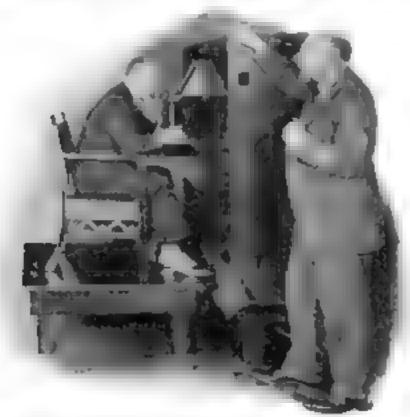
during the original image

Within each of the \$500 sections are two electrodes, connected by wires with no apparatus for making and breaking electrical contacts. This is a brush mounted on a wheel which revolves in exact time with the scanning disk at SNN. As each electrical bit of flying picture in received, the brigh delivers it to the proper wires leading to its uppointed section on the screen. There, in passing across the electrodes, it causes a flash of light sumslar to location and artensity to the corresponding spot of light on the original face.

Eighteen times a second, each of the little sections thus shines forth in turn The successor of flashes is so swift that human eyes cannot note them separately. The observer sees them not as a series of destruct flasises, but as an entre picture. The picture is viewed either directly on the gridake tube or through a translucent screen.

THE system is virtually the same by were no by radio. Its success lest largely in the remarkable synchron grag of motors controlling the apparatus in both the sending and receiving stations. Were n not for this, the thousands of little picture units would fail to reach their proper destinations, and the result would he a blur. To aid in the timing, a secondary or governing motor is employed. in connection with the main motor in each station. In radio vision the timing process is controlled electrically over a wave length different from the one used in actual transmission. The voice is carried on a third wave length. In wired television three separate wires are used,

The development of this marvelous system was effected (Continued on page 139)



At the "aming" end W S. Oifford, president of the American Telephone and Telegraph Company, watching Secretary Houses in Washington as he talks in him from New York. Standing at Dr. H. S. Ives, who directed development of the television apparetus



A New Self Seart refor Alephanes

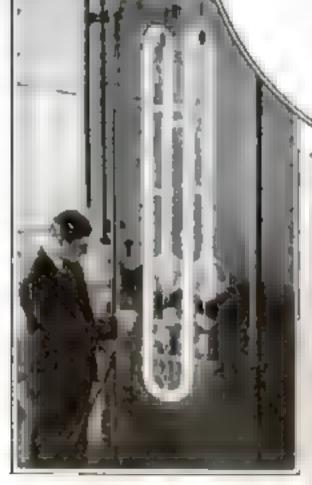
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New Marvels of Ingenuity

A Light That Pierces
Fog — Pictures on the
Clouds—Other Amazing
Ideas and Discoveries

Turkipe Drives Georgess Cor

The large development of the gravities of quark specifies of quark particles of Jackson Mannet and Orbital particles of Jackson Mannet and Orbital particles of the first specifies of the particles of the during lander over a particle of the particles of the par



Strange Light Pie ces Fog

A womenful new light designed of the next latter as the state of the last of t

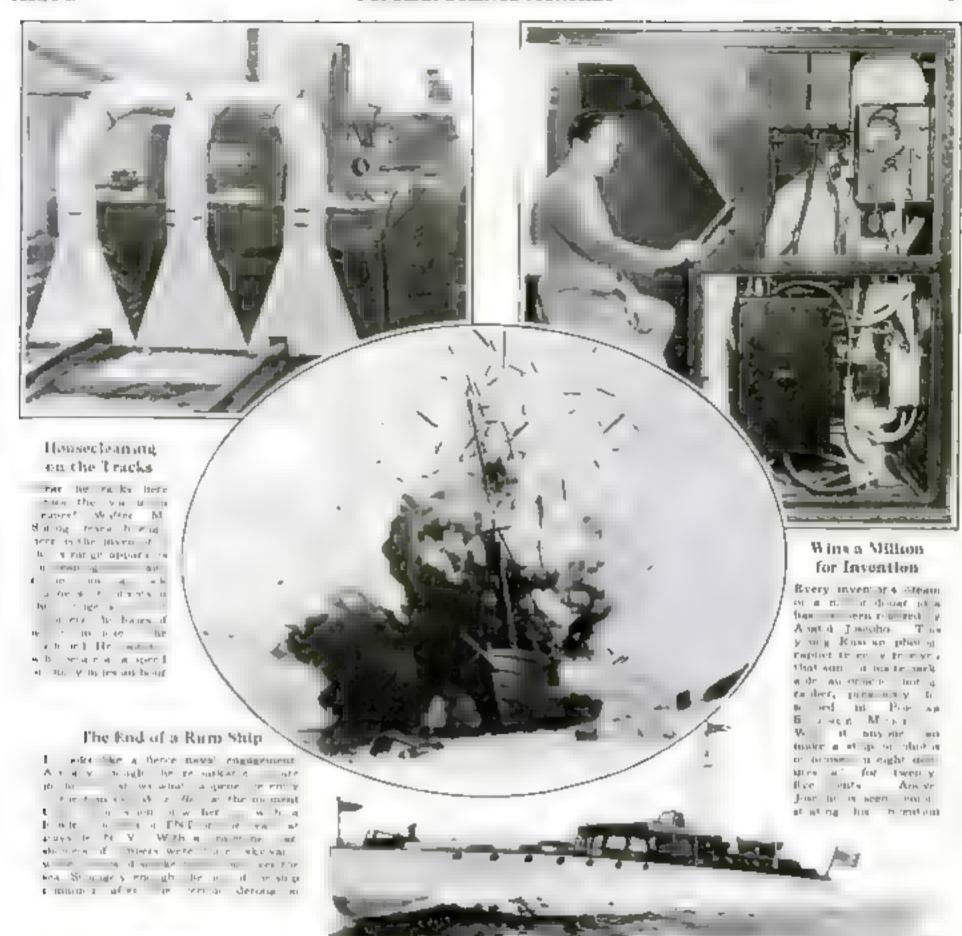


Power and Speed!

The on the thicky Car What y start was Min of A and a read are a first are only a few warms and who expected are on of the base of the area of the formation are read and the whole formation are read and the second are r

Daugh s in a Basket

To study he accelerated topologically of the famous harms Beinge at Standard harman Design at Standard harman List Cherica A. Re is of he American Missessor a National History toward y was set down from he is of he at his who him tidly not higher than Ningara Falls. As he left he is seen at a largest of about 200 feet.



The latest of "Zeppelin" frumer

Ideas terrosced from Zeopero construction are to a to a residentially pure of express a set is an German's fee thin H. Kalin, or a new American financer. From wrett to seen be but a sense a from work to be ight as you set is an ding a rob in. In addition, he is a more a streaming the bull that y are played sion were on a very respectively. There 480 interest were engines are parameters to make a visit in They are so it is well as a visit in They are so it is well as a visit in They are so it is well as a visit in They are so it is well as a visit in They are so it is velocity and translating the of he has early business for one for the forcest business for one from translating the of the forcest business of status.

Shoots Pictures on the Clouds

Like a named annum is appropriative a a gun arms is glis just perfer so for use in a new stor of all set intig. And rest any mast or inserted so were the senses in the basis of the annum ke processor is thrown in a games letters and just the incompany overhead a site. The instrument was developed in the militar as when its the Comman Electric Company. The model above above outsing an engisted both peat shight. It is noticed in the sense outsing an engisted both peat shight in my set above to have images upon jumps for in terminal an analysis.

Black Death

By

FITZHUGH GREEN

A Naval Officer's Vivid Story Revealing Inside Workings of a Submarine

HERE was a touch of mystery to the scene: two stops at a dead stop in the center of an otherwise empty ocean; weather clear as a bell, fresh breeze out of the north of: sea sparkling in the June morning stand me and flecked with whiteenps. The kind of day when ships should be about their business.

These two weren't. Or, if they were, surely them was a very

strange business.

One of the saips was a submarine, the U.S. S. Y 5. To the lay eye also was merely one of those long low black bodies, such as the ocean traveler grew so to fear doring the war. But a Navy man at once would have spotted, forward of ber coming tower, a currous bulbosis growth

On the bridge of the U.S. Naval Tender Falcon, the other yearel in the scene, the sensor submarine officer of the American Navy was pointing to this billbous growth and speaking with

great carnestness

But it may mean death to thirty men air'

Admiral Bowers, Chairman of the Secret Submarine Committee, but nervously at his short white mistache. Why do you say that, Commander Drake ()

Because you can I cut a gaping hole in the top of a sub and initall a movable cyander as big as a boiler without weakening

ker atracture!

Drake a hands gropped the Falcon's screen rad mith I kinickles showed wate. Surely he was the embodament of physical vigor. He stood, legs wide braced, andor-wise, his forky body swayed slightly forward so that his posture, as well as his strong com and fine rinddy features, gave bun atmost an air of defiance.

A third man joined the two. He was a lean individual with ny oversized head and pair face. This speciacies and stools

classed orn as the academic type of man

This was the fagures Dr. Signs and Debrees, internationally known as an inventor and congret The name Defrees already belonged with those of unmortals such as Edwar and Diesel Ling Commander Drake by had been selected from a long list of experts to face, in this secret test, the gravest erisis that had confronted the United States Navy since the declaration of war in 1917

Still worried? Imquired Dr. DeFrees affalily

Drake shrugged. 'I d hardly call it worry After twenty years of submarines a man doesn't worry

"Ab, but the practical operation of a submarine is so vastly



Illustrated by B. J. Rosenmeyer

removed from the fine points of its design " DeFrees' tone was both patronoging and generally amused. To form Commander Drake, for all his years of scafaring aboard aphinerables, was but a highly trained chauffeur,

The inventor turned to Admiral Bowers. "The Secretary

will be up for the first dive, won't he?"

As if in reply, there arraved on the bridge a judicial looking man with a kindly face, the civilian Secretary of the Navy His presence at this secret test was token of the seriousness of the occasion.

" All ready, Commander Drake?" he asked

"We re just waiting for the navigator to check our position, sir Soon as we have the right depth Dr. DeFrees and I will go aboard the X-5 and submerge.

"Just a preliminary test," put in Admiral Bowers, "We want to be sure Dr. DeFreed cylinder fittings will stand the pressure.

THE adjoind nodded toward the bulbons growth atop the V ? This unmatural swelling was the upper end of the "DeFrees Releasing Tarret" a device intended to nake possible the escape of men trapped in a submarine at the oottom of the sea.

The invention consisted of a cylinder of steel about ten feet in diameter and six feet in vertical dimension, inserted into the upper body of the submarue. It had a small water-burst door near its floor and a hatch at its top. It was designed so that in emergency the crew of a submarine could take refuge in it and, after shutting themselves in, release it from the mother loat. Cantained air would float it to the surface of the ocean.

The Secretary questioned Drake: "You still doubt that this

device will work?"

I am willing to take a chance, if it will make submarines safer, sur I believe, though-

Dr. DeFrees interrupted "He isn't taking a chance, Mr. Serretary," he said impatiently "None of those men are

But you adont, doctor, that you have been down in a

submarine only once or twice."

The inventor wrang his long-fingered hands, "But you don't understand, sir" be cried. "As I have tried to drain into



Community Dinke faces the or to Chapper men whose power says in the menda. Hings has be used mire say that he has not it with a with the left girl." There was a torque of Marine. You ex-

Communication we can enclude the stress mist eternion e sevele i se al africa a bagaria e ser a sec to the fraction of a pound! "

"Hat they still kill men." smal Drake doly.

DeFrees' pair face reddened with anger. "Mr. Social. you know as well as I that the Navy has suffered six harrible submaring disasters this year! The people won't stand for this sort of thing much longer. Public opinion will force Congress to scrap every submarine you have. The President will not dare interferel"

THE Secretary best up his hand, "We know all that A Congress has directed us to test your device because it looks promising. But we have brought Communiter Drake all the way from the Pacific to handle the experimental boat necause he m the best submarine officer we have."

"I don't doubt it." agreed Dr. DeFrees ironically

"He has a picked volunteer erew on the A o to take you down. If there is trouble—

"What there won't be," snapped DeFrees

The Falcon's navigator stepped up to Admiral Rowers and and steel.

"We have reached the spot, sir."

The admiral glanced about the horizon where a cloudless sky met the blue sen. Hull-down northward were visible the disappearing masts of a vagrant schooner. A low have in the west told where the had had faded out some hours before. Save for a sea guli or two and the black mobble of the X-5 alream, naught else was in night.

"Here we are, Mr. Secretary " "All right, Bowers, go ahead."

A fing shot to the Falcon's yardarm. While the X-5 flickered

sloft her answering pennant, the admiral added:

"We chose this spot, sir, because it has the necessary depth. We have just crossed the thirty-fathom hoe. That means we ean keep our party private."

I few moments later the Secretary of the Navy warmly

clasped the hands of Commander Drake and Dr. DeFrees, and the Falcon's whalehout carried them to the X-5. On the low deck of the submarine a man trotted forward and disappeared through her torpedo hatch, closing it after him. Another awang shut the engine room batch aft. A busy movement about the tiny bridge stop the conning tower at the center of the submerable soon resolved into a quick final housing of signal gear and other mayable articles. A funt shout drifted across the intervening water

Abound the 1 - all bands stood at quarters. Already Dr. Defrees, gramy and slightly trascible, was below giving final

fourles to be invention.

" Stand by to succeeded " ordered Communder Drake crisply. Placing his box to the voice tube in front of him he repeated the command, which was passed forward and aft. Men in the torpedo room at the how sprong to their tubes, cocks and valves, to make sure they were tight. Those aft in the eighe room stood by to shift propulsion. This last was necessary because the modern submarine is but a big steel torpedo propelled by oil engines on the surface and by electric motors drawing curcent from storage batteries when aubmerged. Oil engines need air that is not available under water. Hence the shift at diving.

"STAND by ballast tanks!"

Men at the admission valves prepared to let water flow into the big side chambers that run the length of every submersible and govern its buoyancy. Not only can these tanks be filled by opening valves and emptied by running heavy ejection

pumps, but automatic pumps keep the boat's balance by after rig the amount of water balast in them when men and material are moved forward or aft

Receiving a report of "ready" from all operating stations, Drake directed his assistants to shift to the "control room. This is the inclosed space directly beneath a submarine's bridge in which are clustered the many intricate valves, wheels, gages, dials, bells, and other appurtenances vital to the operation of the boat. It is the operating room proper. From this point torpedoes may be fired, engines started and stopped, horizontal and vertical rudders manipulated, and every man in the crew reached at an instant's notice.

In the control room Commander Drake looked into the per scope, "the tube that sees around a corner " as it is sometimes called. At the upper end of this tube was a prisin kept dry by a thin a r blast. The prism bent light rays coming in. thus permitting the eye below to look about the sea a surface

so long as the prism itself was above water. "All clear" unersed Drake.

"Clear air, and ready snapped back Lieutenant Harboard, his record in command, a slender sunbarned lad in his late twenties.

"Down rudder! Tanke!"

Instantly the X-5 began to settle. Slowly her depth gage swung over: two fathoms—five fathoms—ten—twenty—

" Easy!" from Drake.

The helmsman "met her" with his burisuntal rudder planes.

"Twenty five," read the gage.

"Up rodder"

"Thirty" lay under the gage arrow

DRAKE thrust his his to his tube. "Fumpe" he believed. "Stop flooding the main tanks! Begin ejection"

He stepped back and wiped his foreboad.

Hurboard's head appeared through the water tight door "Thought this was a thirty fathom spot, ik pper he said.

Drake glanced at the gage. It showed thirty-five fathoms! "For the love of Petc" he shot back. "That's what they told me! This must be a depression in the bottom. All we need in thirty to give the doctor's cylinder a test. Jump back and see what those bams are doing.

Harboard disappeared. But the depth sage did not move. ' Cot up rudder on her? Drake growled at the behasmen.
'Yes, sir; full up rudder."

Stal the depth gage did not move. To an old submarine officer like Drake this fact was ominous. He sprain through the toor leading aft to the engine room, and crashed head-on n to a mark most stropped to the waist

began Drake helping the man to his feet 'Oh, I at sorry

But the latter did not want for him to bursh.



"We're sinking, sur!" The words rattled out in the high pitched falsetto of fear.

Stuking how?

"Man-main battery room port-flooded-"

Drake did not wait for more. He plunged across the narrow deck to the door leading forward. He hurdled through and landed with a splash on his feet in six inches of water.

There was no panie. But for a few minutes the X- F_{S} main deck was a scene of swift at tion inspired by the common knowledge that pressure of the sea outside had sprung a seam leading to the flooded battery room, which in turn had, at the moment, an opening forward into the torpedo room and aimidships into the main deck.

JUST as Drake had feared, the coring out of a large cylin-I drical space for the DeFrees turret had weakened the integral structure of the yearel. Theoretically, even the weakctied scanus should have withstood the presuire she had descended into. But it so happened that a beavy sea had caught the X-5 at the moment she went under. In consequence she was rolling when she reached twenty fathoms. Thus to the terrific pressure of 130 tons of solid water above her was added a twisting movement which the theorist ashore in his study would not likely have anterpated.

As a result, a side plate that ordinarily would have been supported by a - thwartships strut, removed to make room for the Defrees turret, buckled under the thousands of pounds of pressure, and several of its rivets collapsed. Instantly tons of water rushed in before the bornfiel seamen had time to close

water-tight doors and isolate the flooded space.

Drake quickly saw what had happened. A gleam in his eye showed his appreciation of quick action by two torpedo-girmens in getting the doors shut before the X- θ was completely lost. Then be turned back to the control tower. Thirly men had paced their lives in his bands and he must not fad them.

Unexpectedly Dr. DeFrees blocked his way. In the excitement Drake had almost forgotten fac inventor. Now he giared

into the mairs pale fore.

It was easy to see that DeFrees was much shaken. Has hos were colorless and his hands Iwisted nervously

"All tile lenk?" he asked in a desperate effort to hide his fear

behauf facetrousness.

"Yes—sure," replied Drake mechanically. He brushed by the inventor and dashed back into the control room. Pages of the men he passed were tense. They, too, sensed the dreadful fact that at any assument the $X \to x$ parts anglet crack again gist admit another flood.

haven as Drake sprang through the water-light door to his valves and switches the men had begin to gather in little

helpless groups and whisper among themselves.

Black Death

The Navy term for what happens when a sobmarine goes down and sauffs out the lives of her men. Would it enter the X-5?

Again Drake backed his commands.

"Mann pumps on torpedo room! Full—ahead" He was a man clear through. But fear grapped lum now; the kind of fear which, to the brave man, is a tome for swift action and terrific effort.

QWEAT poured from the face of the machinist at the main clutch as he awang his lever over-Fear gripped him, too. But, unlike Drake, he was fully conscious of it. To him ' Black Death' was a far more visible horror

The pumps grouned and the engines span until their oily packing began to amoke. But the depth gage pointer in front of Drake's staring eyes seemed glued at thirty-five fathoms. This depth was dangerously great. Weakened seams might start at any moment under the pressure and aster I more water. The men would me before a resence could possibly be organized above them,

"Stop" rasped Drake. To Harboard he barked. "Get all hands but those at pumps and

awitches. Sally ship!"

"Aye aye, sir!" Harboard mustered the men into a "sally ship" gang. I niter his sharp orders this party ran back and forth across the main deck in a frantic effort to shake the X-5 loose, while Drake operated the controls.

For twenty minutes the feverals struggle went



Or, DeFrees' face reduceed with anger. He up t taking a chance, Mr. Secretary i can a med the toward of these men are."

Ther efforts were futile. 'Hold everything!" med Druke.
The engine room had become a sweltering prison, almost tull vable from the thick smoke of overbrated inbrigating oil.

"Harboard, man the oscillator! Don't let the operator be stoped. Tell the Falcon we're down and stuck here. Make it souppy!"

Vyc aye, see "

THE panting erew propped themselves against the X-5 s claimay halkheaus while the pantor officer borned forward to the electric vibrator which could shoot bound waves under sates to a receiving map ragin to the outer skin of the Entern

Two remotes later be was back for og Drake.

"Our bator flooded, supperable said

arguige and Harboard's rivel me " Star-

then the

"It is, skipper "

For a ma neut Drake barred his face in his hands. You know, he said "there also rescue craft closer than New York. Harboard nodored.

And the only pontoon unit on this coast is at Boston. So if we can't aignal to the Folcon nothing will start toward nationary."

To both men after many years of service in the eggs." Their pight was plane. Long before drags could locate the X-5 take in her of they laid not drowned, would have gasped their last anguished breath. The Falcon was helpless. So far as she was concerned, when her oscillator faded to rouse the submarine the admend and has companious could come to any conclusions for all they knew, the X-5 might already hold the lifeless bodies of her crew. Her silence might mean anything from an explosion to a cuptured seam.

Drake stopped to Harboard's side. "We mustn't weaken, old man. Those lads out there are scared stiff already

' So on I 'said Harboard frankly.

Drake forced a smile. "Remember that the boss of the whole works is up there on the Folcon. The Secretary can move any slip in the Navy. He'll stick right by us. The weather is fine."

" [know, skipper, but

In the doorway stood Dr. DeFrees! His ashen face twitched, as he fought to conceal the terror that had already drenched his garments with cold sweat.

Grave-we d better-try my cylinder " he stammered "Can you heat it!" exclaimed Drake, "Honestly, doctor, in

all the excitement I hadn't even thought of it!"
"But there isn't any other way, is there?"

'Not that I know of. We're flooded down forward. Our pumps can't handle such pressure. We're down too deep to send a man up through our torpedo tube even if we could get to the torpesto cook. We haven't enough ballast to change her true. We can terminimente with the Falcon. All we can do is sit here.

"Well, way not use my exhader?" repeated the inventor weakly. "We came out here for that very 1 pag, didn't we?"

Not a trace of the patromaing air and condescension he had shown toward Drake on the Falcon was left in his minutes. Rather was he like a frightened child who bega assurance and comfort from the older and more experienced parent.

"All right, let's see," and Drake with a touch of irritation, One could not blame him, aftice it was the doctor's "Releasing Turret—that was to blame for the X-5's predicament.

Out in the main country about the control room were gathered the erew. They knew the pumps had refused to work. Sollying hadn't budged the X-5. As a scafaring vessel she was deaf, damb and bland. They knew it meant they might have to die there on the foor of the sea. They were have men. But it is one thing to face death in the heat of action, another to face it in the glastly scence and impetion of a sanker submarine.

As Commander Drake entered he was surrounded by a circle of silent but be seerbing scatters whose doors lay to bus bunds. He more could save them. Already the air was thick with make and the sharp bite of chloring gas from the batteries.

DRAKE spoke briefly: "Men, you know that Dr DeFrees invented the cylinder here behind me. You can enter this cylinder by its hatch—" indicating in I I is hand. "Then it can be released from us. Contained air will float it to the surface with those inside. This cylinder is not big enough to take all Those of you who want to risk it can draw lots. The bicky ones can go."

The chief machinist stepped forward. "That's all right, captain. But what do you think about the safety of the

blooming thing?

Drake shrugged. "I don't know much about it, chief Frankly, I have my doubts whether it will stand the water pressure when it lets go."

DeFrees clicked las tongue angrily but none heeded lam.

"Will you draw too, captain?" the chief went on

Drake shook his head. "Forget me" he said simply "I'm in command. So I'll stock with the old girl."

There was no vain glory in the quiet words, no effort at dramatic renunciation. Just a plain statement of fact. But their effect upon the men was electric. Instantly rose a chorus of "Me too!" "You bet!" (Continued on page 131,

Car Makes 207 Miles an Hour

Giant 1,000-H.P. Auto Demonstrates



The victorious pilot, wind-blustered and with wrists larged from botting the macking to its course, bring carried away by admirers after the race

run over the canda of Daytons Brack, Pla. in the Mystery S the rearing car was merely a blur of red gone in an instant. Nothing like its speed has ever been made by man on land

WAS going so fast I couldn't look at the speedometer! To guide the car. I had to forum my eyes half a mile wheat. If I had looked at the dud for an instant I mught have lost control I and it know the car had made 200 until after the run

The British speed king, Major H. O. D. Segrave, was describing his recent experience in driving his manusoth bunbeam rucer, the Mastery 5 over the sands of Daytona Beach. Fla., for a world s record of 207.01 inter an hour. If you can magne an automobile covering a city block in less than a second, you may conceive—possibly—of such terrile speed

The real marvel of the Mystery S. however, is not the record itself but the maryeloga way accesses overenous the mechanical problems presented by the demands of imprecedented speed schieby, the conquest of word resists ore through its inthese power plant and its body design.

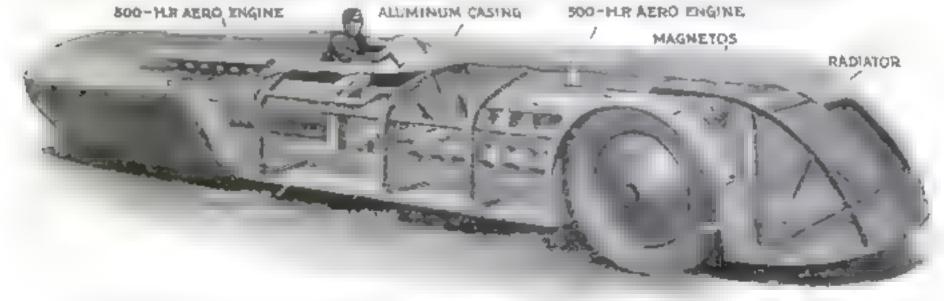
Wind resistance, of course, increases in far greater rates than the increase of speed, to double speed requires an engine not twice as powerful but eight times as powerful. Segrave a car was arrived by two twelve-evl-uder engines, each developing 500 horsepower. About half of this power was needed to overcome wind resistance. which at 200 miles an hour amounted to amost half a ton! To the same end, the wheels of the cut were hidden under a smooth, blunt-noved body of radiculty different design. This projected the air apward a stead of against the wheels and axles as in the conventional type of speed car with pointed radiator. The pilot a head was the only object exposed.

Lires, too, played a vital part. The builders spent righteen months developing tires that would last for three minutes at 200 miles an hour. If a tire had blown out the prior would probably have been killed tastmatty

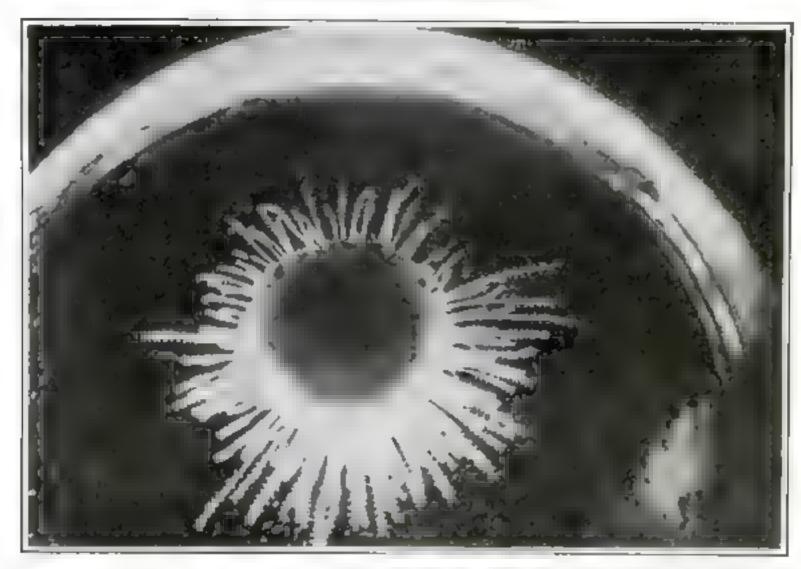
It is a frenk car, and Segrave says it will never be driven again. But it has served

its purpose. Resides demonstrating that the present orthodox design of motor carcan make 200 miles an hour, it has shown where improvements must be usade. The present des gn of brakes, for example, proved wholly unsatodactory, the terrific heat generated causing the metal to melt

Segrave's record in the fastest man has traveled on hand. The steam locor office record in 120 miles on hour. The amplane record is 276-not so far ahead of Segrave's 2071 Will man ever travel faster on land than that? The British visitors producted that within eighteen months an American manufacturer would build a car that would break the record made by the Mystery S.



The marvelous mechanism of the Mystery 5. The car is capable of 65. m.p.b. in first speed, 175 in second and 207 in third. The two cagainst, back and front, must be synchronized before the main clutch can be used. and if they are not operating at the same speed the car will be wrecked



This luminous sellytisk, found in the Sargasso See, is one of thousands at creatures that illuminate the arran. The beautiful corone, or hair, or thrown by a pwn (cynn sight

Science Reveals Secrets of "Cold Light"

Studies of Luminous Insects, Fish and Bacteria May Yield Key to More Efficient Lighting of Our Homes

By Ellsworth Bennett

CIENTISTS are on the verge of far-reaching discoveries which eventually may make the meandescent electric light as out-of date as the old fashioned kerosene lamp. They are learning the secrets of a lighting system used by Antare for ages, yet always a mystery to man—the production of light without heat.

In a laboratory at Princeton University, Dr. E. Newton Harvey, professor of physiology, recently utilized the materials employed by fireflies in the munmer to flash their lamps, and by fishes in the seas' depths to light their lanterns to produce continuous "cold light." Doctor Harvey believes that accence will be able soon to create these materials artificially

At the United States Bareau of Standards in Washington, two other scientists. Dr. W. W Coblents and Dr. C. W Hughes, have just succeeded in analyzing and recording the intensity of the light envited by various luminous animals and plants. By studying the spectrum—that is, by dividing the light into the rambow of various colors, or wave lengths, that compose it, they have demonstrated that

thus "living light" is virtually a hundred percent efficient in its radiation. In conparson, our best electric lamps, wonderful as they are, are worfully wasteful. In the laboratories of some of the larger electrical communica, still other experimenters have made lifeless substances glow without beat under strange myisible mys.

Since the beginning of time men have produced light by heat, by burning substaures such as wood, tallow, od or gas, The higher the temperature, the brighter the light. In the modern electric lamp we use electrical energy to heat a metal filament to the highest possible temperature and make it glow

The incandescent lamp, marvelous invention though it is, shares with every other form of hot light the drawback that most of its radiation is in the form of heat, and not light at all. Less than two percent of it is visible light. The rest is wasted for the reason that the heat cannot be separated from the light.

Lummescence, or living light, on the other hand, contains nothing but visible light, as Doctor Cobleuta's experiments have proved. The firefly's light scall light It is fifty times as otherest in light radiution as the finest meandescent lamp!

The glow of living createres is only and of several different kinds of cold light, produced in widely different ways. l'lace your hand under a atrong electric lamp, and your sam and finger hade walgive off a glow. This glow is not reflected light, but is actually produced in the skin and nails. If the lamp light can be acreened from view, the strange glow will becume visible. Your hair, teeth, eyes, or almost any other part of your body ean be made to give off similar light. This is fluorescence. It is explained by the theory that the body tissue has the mysterious faculty of converting rays of one wave leagth into mys of another wave length.

LIGHT, as we commonly know it, is amply the part of ramant energy visible to our eyes. In common with radio, A-rays, ultra-violet rays and other forms of radiation, it consists of ether vibrations, or waves. The differences between all of these has simply in the length of their waves. Thus, the wave lengths of

ultra-violet rays and X-rays, for example, are shorter than those of visible light while heat waves and radio waves are longer. The different colors of the rainbow vary in wave length, too, from the shortest waves of violet to the longest waves of red.

USUALLY in fluorescence, short wave lengths are converted into longer wave lengths. Thus, many substances, including silk, wool, bone, born, and numerous kinds of living matter, have the ability to convert investile ultra-violet light, which

has extremely short wave lengths, into visible fluorescent light.

Dr. R. W. Wood, of Johns Hopkms University, Baltimore, recently gave a spectacular demonstration of this kind of fluorescence. He directed ultra-violet rays from a filter lamp into a vessel containing necessing, a substance extracted from the bark of the horse-chestnut tree. Immedately the solution shone with brilliant greenish-blue light. So vivid was its Chummation that a photographer, by its light, was able to take the picture of Doctor. Wood reproduced here. Other substances exposed to the rays produced glows of varying tints.

In somewhat similar fashion Dr. W. D. Cooledge, of the General Electric Company inventor of the improved cathode ray tube, has made rocks, crystals and other substances glow with beautiful lights after exposure to cathode rays, produced by streams.

of electrons.

Sometimes substances will continue to give off fluorescent light after they have been removed from the "excitage" light. In occtain cases they controls to glow for hours. Tois perestent light is called physphatescence.

A faint rold light may be produced by rubbing two lumps of sugar together so as to crush the

ought crystals. A similar light appears if you shake crystals of minimum patrate in a tobe. Every I me the crystals but each other a offic flash of light is produced. This is called tribusing reserve. Again if you take a roll of electrician's adhesive tape and rapidly strip off the tape, a fact glow will appear at the instant the tape breaks away. The light is believed to be raused by the rubbing together of mariste crystals on the tape.

Certain chemical mixtures, too, produce heatless light. Thus, if to pyrogalis acid—the familiar "pyro" used by photographers in developing negatives—you add hydrogen peroxide and a small quantity of potato mice or animal blood the mixture will become luminous. This

as known as chemiluminescence.

But it is in "living light" produced by animals and plants that scientists see the greatest possibilities for future usefulness. Some of these humanous creatures use lamps argenious amost beyond belief

In Doctor Harvey's laboratory at Princeton you can see a glass per half filled with small grayish crumbs resembling birdseed. Once these crumbs were tiny crablish creatures called (**pridina**) living in sea water near Japan. They carried little lighting plants in their bodies which made them glow. Now they are dead and dried. Yet today these dry crumbs, moistened with water mine-directly give flashes of blush-green light. There is no burning, no heat. The strange source of light seemingly is undying.

On the earth, in the sky, and in the sea are countless other living things that manufacture light. Passengers on ocean liners often see the sea apparently burst into a vivid glow when stured by the passing ship. This light, commonly



The only light used in taking the remerkable picture was the greatest blue glow from a substance in house chestnut tree back when exposed to ultra wolet cays. The photograph shows Dr. Robert W. Wood, physicist, of Johns Hopkins University, one of the scientists seeking to copy Nature's methods of right production.



Spectrum chart showing two typical luminous creatures a hundred petrent efficient in light faculation. All of their rad excent it in the vashle part of the spectrum in other words, bond of their rays are lost in heat beyond the rad and, nor in invisible rays beyond the wolet end

called phosphorescence, comes from millions of light-toaking annuals, most of them so small that they can be seen only with a microscope. And in the depths of the ocean are strange fishes that daugle gleaming lauterns from long stalks projecting from their heads; others with rows of lights along their sides, like a ship with lighted portholes.

In the waters of Japan lives a squid that brandishes lamps on the ends of its tentacles. As it swims it waves these lanterns, flashing them on and off. The Japanese call it the "hotaruska" or "firefly squid." Laving in perpetual darkness in the depths of the Mediterranean is another squid which, when danger threatens, squarts a lummous substance into the sea water.

THERE are marine worms that turn on their lamps when attacked lummous sponger, jellvlish, carthworms, centipedes, startish, glowworms, strumps, crabs and many others. They number tens of thousands. In all, at least forty orders of animals include one or more forms capable of producing cold light.

A large number of deep-sea fishes are equipped with lamps that resemble sur-

prisingly man made searchlights. There is a double convex lens for directing the light in a beam. Back of the lens is a layer of cells containing shiny material which acts as a reflector. The light. produced in the center of the organ, is thrown against the reflector which shoots it out through the lens in a concentrated beam. And some of these lightproducing organs are fitted with color filters which allow only light of certain wave lengths to pass, thus producing a definite color One deep-sea cuttlefish, for example, posteries luminous organs of at least three different colors blue violet, and redd sh. A certain South American psect called the natumobile bog conveniently enough has a white light at its hend and a red light at its tol-

The plant world, too, contains at least two light-making forion. No doubt you have seen damp wood glow at night. That "for fire " in produced entirely by forgus in the wood. Or perhaps you have seen ment or fish in a refrigerator glow in the dark. This faint light comes from interoscopic luminous bacteria. The fungus and bacteria both are

prants

Oddly enough, the bacteria, smallest lamps in the world, have proved the most useful in the study

of living light. Bortera give of light continuously, and colonies of them can be kept alive indefinitely. Doctor Harvey not only has measured the intensity of their light, but actually has computed the efficiency of their lighting inscharious and this despite the fact that the bacteria are so small that \$2,000 of them, placed aide by aide, would barely fill an inch. The light of a single one of them cannot be seen even under a microscope. Only when thousands are together is their illumination visible. It takes 50, 000,000,000,000,000 of them to equal one candlepower of filumination,

DOCTOR Harvey measures their light by making an emulsion of belieus of the bacteria in sea water. Then he counts the mainter a car her bic centimeter, measures the light emitted by one cubic centimeter, computes the light which they absorb from one another and so care ulates the light which each individual would send in all directions if there were no absorption. By measuring the food and oxygen consumed by the bacteria in relation to the amount of light energy produced, he estimates their over-all efficiency as



New Plane Stops
Like an Auto—

"Sea Hawk" Rivals the Birds in Speed Range and Control

NLY as feet of air separate the plane from the ground. Motor rearing, it firsts with the carth. Gracefully, lasily, it skins closer, throttled so slow that a fast motor ear could outdestonce it. It too her rises again, where separates from the contact mad airly circles the first Now it lands. Rather, it "sits down Instead of bumping for many yards along the ground, it glides to earth and stops within a few feet!

This was the first public test, the other day at Mitchel Field, N. Y., of a remarkable new fighting airplane, the Sea Hark. built for the 1° S. Navy. The plane's case of maneuvering at slow speed and its hydraulic wheel brakes indicated that it could land directly upon the deck of an airplane carrier.

purplane racties.

Yet when its 425 horsepower motor is opened up, the plane achieves a speed of 1.8 miles an hour. The Sea Hark is called the fastest plane in the world equipped with an air cooled motor.

Embodied in its construction are a thrust-back lower wing, enabling the poot to see his landing gent; shock absorbers, staggered wing construction.



T N. Joyce test pilot, and the new plane. The wheels are equipped with hydrauhe brakes, operated so in an automobile. It also has shock absorbers

Speciation gasped as the Sea Hawk performed these dangerous feats. Upper photo "standing on a wing tip while making a turn. Lower photo, tourhing wheels to ground and roung plays again.

and curved upper wing, to avert danger of the deadly tail spin. It can be converted in a few markes into a scapione by the addition of portoons. Inder the cowling are two machine guns, which fire through the propeller. Neat lettering on various compartments along the first-lage show the location of the engine crank, log book, fire extinguisher and tools.

Novel safety devices—features usually sacrificed to speed and maneuverability in lighting planes—are provided. A botton in the cockpit, in case of fire, squirts extinguisher fluid on the engine. A valve empties the gasoline tanks into the sea in an instant. And a rubber lifehoat is within reach of the pilot, provided with bettles of liquefied carbon dioxide gas that inflates it in six seconds, and small oars for paddling, if the plane should fall into the ocean!



The pairs of figures above indicate by their comparative sizes the populations that will be supported eventually by different regions. North America will support \$30,000,000, of whom 200,000,000 will be in the United States. The equatorial regions will be denseit

City Populations Predicted from Study of Flies

Experiments with Pumpkins, Yeast and Ruts
Make Possible Forecasts of Cities' Growths

By MYRON M. STEARNS

one of the research laboratories of Johns Hopkins in versity at Baltimore. We glong it with particular care, for a strange reason—to find out what the population of New York City would be in 2000 A D.1

The study of a rat's growth came is the course of an investigation by Dr. Raymond Penn. Director of the Institute of Biological Research at Johns Hopkins, by means of which he has demanstrated that the increase in population in a given region at country one a particular period of time can be forefold with almost unbelievable accuracy.

For seven years Dr Pearl has been studying popula ion growth. The tirst observations were made with a pumps in, which like aid other hiving mult exhibit organisms, grows by the division and redupatentian of its cells. A single cult requires the limit of its size, then splits across the middle and becomes two cells. At first it looks as though the process could go on forever, with the pumpkin getting higger and ligger, that Dr. Pearl discovered that at first the pumpkin grows rather slowly. Then the rate of increase becomes much more

rate I broadly after it reaches maximum speed, it begins to slow down again, the slowing down rate amost exactly reversing the acceleration. The five-sion of cells becomes less frequent, and the pumpkin, reaching full size, stops growing.

The investigation shifted to the tail of a taipole. If a tadpole loses its tail it promptly grows a new one. Doctor Pearl wondered if the growth of a new tail speeded up by Nature to meet the emergency, was similar to the normal growth of a pumpsin.

They found it was. As in the case of the pumpkin, the new tadpore tail began to grow alowly. Then the rate rapidly ricreased, the single cells that composed it dividing faster and faster, until a maximum rate of growth was reached. After that the process slowed down as the tail approached full size, and then stopped altogether.

THEN there was the rat—and again the growth tallied with those of the pump-kin and the tadpole's tail. But, pumpkin, and tadpole tail, however, all differ in one respect from any growth resembling that of population. The new cells remain with the old cells to form a single

whole—the whole rat or the whole pumpkin. But Dr. Pearl was endeavoring to trace a similarity between the growth of the rat, the pumpkin and the tadpole tool in an effort to esta ash that the scenningly haphazurd mercase in the mumber of pisphe in the world in reality follows similar fixed laws. To come a step searer to the growth of a hanna population, an experiment was next treal with frant fixes madicipality or games that can fairly be compared with a human population in their in dependence of action and response to our manneral.

TWO front flees were put into a hulfprot bottle with a quantity of bananaagar a gelatinous food supply sufficient to nourch a whose front ity army. The female laid her eggs, the eggs hatched and soon the bottle was teening wit a population. Regular counts were taken to note the rate of increase. As the population grew, the rate of increase grew with it. Then, with the bottle becoming too crowded, the increase slowed down and finally stopped a together. The fruit fly worst embodied in the ball-port bottle had all the population



it had space for. Only enough files were hatched to take the place of those that died. The law of growth had operated exactly as with the rat, the pumpkin and the indpole stail. A similar experiment was made with yeast, with like results.

THEN cause the final step; to apply the I results of these experiments to actual lucismic conditions. And since, obviously no experiment with luminas count be made in a single lifetime at meant turning to history, to Sweden, where population figures have been remailed since 1730. Sweden't population growth daming that time was compared with the populafrom of the front thes, it the half-pint hottle. Set mg the Swed sh census figures for ench necade, from 17:00 to 1920, down on a chart in curve was shown adoost ideatical with that of the experimental by population! The eccentists made entculations from the laws of growth that they had found applicable to the cells of the

pumpkin thetadpole stail. the est, the yeast, and the fruit flies-and it worked just as well for Sweden. Mathematically, according to the law they worked out, the Swedish popula-I an for 1800 would be 2.302,000. The actual figare for Sweden in 1900 wits 2 447 000 For 1830. the in enlations gave 2300,000. Sweder's ac tual population to 1800 was 8888 860 The calculation for 1970 was 5.873,000 while the host Sweepsh census in 1920. 3800 J.000 J.008F

They worked out figures for the United States, where the population has been known with comparative accuracy at least since 1790. Another striking corroboration of the law of growth was obtained. The parallel

was as close as that of Sweden. For 1800, for example, the calculations showed the l'oited States population, according to the law of growth, would be 5,336,000 people. As a matter of fact, it was 3,308,000, For 1900 the calculated figure was 76,870,000 while the census count was nearly a nobion less—75,993,000. That was just after the Spanish War. But by 1910 the two sets of figures had come together again 91,972,000 calculated and by census 91,972,000.

Thus any country a future growth curve can be worked out from the figures of its present and past growth already known in France, for assistance the counts figures show her population increase slowing up just as the front fliss did to the hottle after the population had approached its austrania. The United States, on the other hand is shown to be only a little past the middle of its era of expansion. According to the growth law figures, our population will be 184.678 000 at the end of this century.

with the "infurstion point" reached a hundred years later, just imude the 200,000,000 mark.

With all such calculations, however, one important thing most his borne in mast. They are all based on the assumption that the general conditions affecting population growth remain the same past as the conditions for the fruit fix experiment remained the same. Conditions affecting the Swedon population bave remained practically unchanged sines 1750. In exactly the same way the population of the limited States has developed strictly in accordance with the law of growth for more than a century.

INCIDENTALIA, it is interesting that the tremendom immigration into the United States during the last century dal not affect the law-of-growth figures appreciably. According to the law that Dr. Pearl and his associates have worked out a country will fill up with population.

under & certain set of conditions just so rapidly. and it makes little deference whether the morease m by birth and natural growth or in pact from immagration. Wars, even, make little difference, unless food supplies or reonomic conditions are permaniently affected. For a decade or two Lie ponalation figures vary a little as the result of such as upheaval as, for instance, our Civil War. Jaen the normal growth is resumed. peactically unchanged. In Europe another

selectist, Professor Albert Penek, has submitted to the Prussion Academy has belief that dense populations of the future will move to the tropics. He estimates that in place of the present world (Continued on page 140)

How Your City Will Grow

IT IS possible, taking De Pearl's "law of growth" as a basis, to predict accurately the populations of American cities by the end of the century. The following figures show how eleven leading cities will rank seventy-three years from now—the shifting of Detroit and Los Angeles to third and fourth places being among the most interesting changes.

1950	2000 A. D
5.731,000	13,948,000
2,701,705	5,400,000
993,678	4,750,000
\$16,6.3	4,125.000
1.823,779	3,575,000
733.826	1,725,000
772.897	1,556,000
748,061	1,450,000
315.312	1,175,000
506.6.6	1,141,000
588.3-13	893,000
	5.731,000 2,701,705 993,678 \$16,6.3 1,823,779 733,826 772,897 748,064 315,312 506,6.6

Invents Amazing Electric Relay

Engineer's New Control Tube Runs on a Billionth-Watt

A GOLD watch lay on a plushcovered table in a New York hotel Near by was a small glass bulb. A man extended his hand to the watch but even before he could touch it, an electric alarm rang

A bighted match was held between the third wires connected with the built. The hell rang again. The same thing happened when a drop of water fed on the wires, and again, when the window shade was rossed, admitting sunnight!

These magnest happenings were demonstrations of a new relay instrument, said to be the most sensitive of its kind ever made, the invention of D. D. Knowies, 98-year-old engineer of the Westinghouse Electric and Manufacturing Company, A relay is a device that controls a large electric current by a much smaller one. The Knowles "grid glow" will respond to a bihouth of a watt or one fortiets the energy exerted by a fly combing an inching the wall! It can imagnify electration the wall! It can imagnify electrationer a lumided million times, compared with the ten thousand times of the ordinary relay.

White its chief use will be in the auto-

Before the good give relay to at some two and an interest and an interest of the DID Knowledge of the source of th



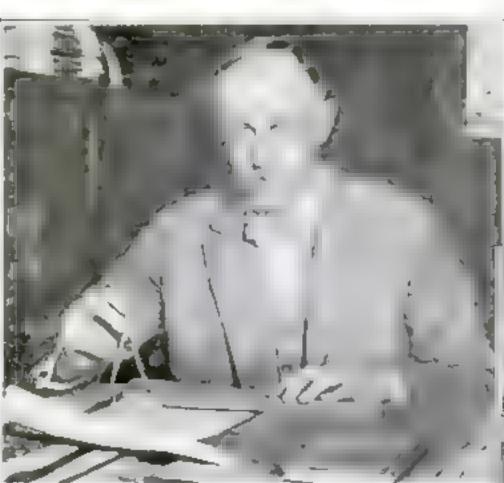
When a risk of where it could be so many

nutic control of electric machinery and devices, the relay can also be used to turn lights on and off automatically to count people, automobiles or products passing a given point and to protect valuable exhibits in stores and museums

The both is gas filted and, like a radio

time comments or clear por small a gold through an instruction polls are connected in the circuit co be engined acts as a galeway or brockade against toe flow of current. When some minute of the influence, such as the movement of the hand in reacting for the watch, draws the charge from the grad the galeway opens and the current flows, operating the beli-

Longest Power Transmission Near

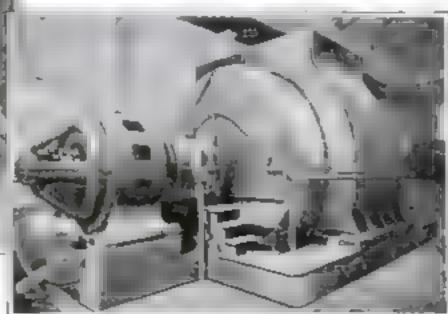


Frank G. Bauch. San Francisco engineer: whose revery synchrone as regularor or engineers is halled as one of the most one-train covernment over made in the handling of the tricity. Interact a photo of the apparatus

CHEATER on the Country of the second of the

At the enterthine continues of negligible of the extent of

The end new transfer the product of the product of



Forty-Niners of 1927

Motor Cars, Airplanes and Modern Machinery Mark Latest Stampede for Gold in Nevada

By EDWIN KETCHUM

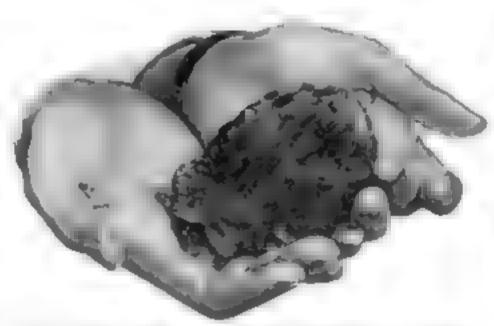
ARLY this apring two inneteen year-old hovs, prospecting in the barren hills of Esmerada rounty, southwestern Nevadarian upon a badger hole. They drig arto the hole. At the bottom instead of a badger, they found a ledge of rocks shot with streaks of gold. The boys staked a claim and carried samples to Tonopals, thirty miles away. The rock assayed coormously rich—\$78,000 a ton

That was the beginning of the new gold rush at Veepali. Nevada, which has apread its fever up and down the California border and usheres in a new roomnice of treasure.

The two boys, Leonard Tray nor and Frank Horton. Jr., dug up chunks of rock streaked with gold in ribbons half an inch wide. News of the find traveled swiftly. Prospectors, merchants, clerks, financiers and tourists drave across the magebrash to Weepah in thickering clouds of dast. There was a sermoble for clauos. Other lacky strikes followed. Ed McKel vey, veteran issues strolled in from the hols with surface gravel valued at 8.0 a possed Pine Nut Johnny a Pinte Indian brought news of another rath find at Burrel Springs, five males away.

Within two weeks a forest of claim stakes sprawled over some 4,000 acres of desert, and a lifeless stretch of sage wish and sand bud been transformed into a triving camp of terts at a shacks. Claims

Today the good fever is raging along a thousand more front from Phoenix. Aria in the south mong the California boundary to Oregon and Washington. Gold-field, Nevada, seene of a great rish of two decades ago, experienced a sympathetic boom. In the Arizona desert a race of motorists began when two old-timera, Dan Meteraw and James Grand.



Dig your flat into rocky soil at Weepah. Nevada, and you may pull out a hangful like that A hundred dollars' worth of gold was passed from it

told of a pay streak assaying \$100,000 a ton in the hills near Drapping Springs. In Cabfornia another rush centered in the Band destrict, near Bakersfield, a region of deep mines which have produced inflions of dollars in gold and silver. Similar symptoms appeared as for north as Walla Walla, Wash., where J. D. Walter, a botcher, found an gold nuggets in the crops of two chickens.

EXCEPT that the old spirit of adver-ture and the thrill of gambling for big stakes are there, this new stampede is far different from the fumous gold rushes of the past. For in the three quarters of a century some the California magness of 40 even in the quarter rentury since the beetic days of the Kloonike Tonopali and treateld, mechanical science and electricity have wrought mighty changes. The prospector's slow moving burro has surrendered to the flyver the roudster, even the aicpose. Fiectine lines are properied to supply the new mining camp with light and power. For a time the prospector's pack, shovel and pan may serve to locate "pay streaks", but soon hand tools must give way to blasts, electric drills and moment uniting pischinery

For in the part of Nevada where Weepah lies, most of the precious yellow metal ts hidden in rockit i in deeprunning years of quarts, or lode. Unlike the placer deposits of early California or the Yokon, where nancra washed golden dust from the gravel of streams, the Nevada treasures must be recovered by Jinlong deep shafts and running levels and drifts to follow the lode. Electric hoosts must raise the quartz to the surface. Other machinery must crush the rock to powder

and from it extract the gold by washing and other metallurgical processes. This is known as quarta mening, as distinquished from placer or hydraulic mining.

At Tonopah, Goldfield and other work sugs, veins of quartz have been followed for thousands of feet. In the famous Constock lode, shafts were sunk so deep that miners were able to work only an hour or so at a stretch because of the unbrarable heat.

Vote one es such as these gradually are "worked out" and abandoned. Then it often happens that some lucky prospector stambles on a rich new your where it crops out near the surface, just as did the two boys exploring the badger hole.

NOONE knows for certain just how the vents of gold lader quartz came to be in the rocks. Geologists generally behave that in ages past deep subterminent streams carried same and gold in solution under terrific heat and pressure. During one of nature's upheavals these waters geysered up, filtering through cracks and besures in the earth's crust. There the disacrestatized into quartz, and the



Scene at the gold runb cump at Weepah. The "locky strike" was made in a low hill overlooking the camp, which originally had only four frame dwell

man. Spreading like wildfire, the press brought a population overnight, to transform the desert apot into a place of tents, shacks and automobiles



The two boys who, while prying any a me ager have induce he say be not set at the Wrepah reads. Right new Frank Highly and Jr. Lectured Trayers and young Meeter a street

gold with it, foling envices be tween rocks and this borning

An unusual for second the West pah strike, say the 31 timers, was the discovery by Ed McKelvey of rich gravel or placer deposits on be surface, in adoction to the lode. The presence of this "pay dirl," they declare, toos assetreable in the new nameng enop. for pader the state laws prister. have open until a many to the property post rage as intreads stoked on t Car quarte or aids treating. I we two classes of clasms may be filed on the same area, the placer moner being entitled to all the gravel down to the regular lode.

The great placer discoveries, such as those of California and the kloudike, usually have been along atreams. Through the ages, as mountains have

been worn away by the cuments, particles of gold have been washed with the soil into streams. The metal anks to the river bed, the lighter material being carried away.

AS STRANGE and rethe Weepsh badger note bare been the histories of the richest placer finds. The stantpede of 40, for example. was ashered in by two men engaged in the provide work of building a sawreill on the fork of the American River, near the present site of Sarramento, Cal.f. One of them, examining the tail race of the mill, was attracted by a glitter in the sand at the bottom. Within a year hundreds risked

bardship, danger and death to explore neighboring streams. Fifty years later the story was repeated in the Yukon, when men bravel the Maskan wilderness to saft gooden gravel from the Bonanza Listorado a p d o t be r treasure fixed creeks. In a single year they won \$22,000,000.

the leaviness of good which has setted on stream beds at it quality which room have employed to advantage in developing methods of placer mining, in which the gold is separated from the gravel by washing. The simplest method, and the one widely used in early days when surface and days when surface and days when surface and days on a paratively common, is a soon a paratively common, is a soon a paratively." The prospector fills a



"Seldom Seen Sim," familiar figure in the fearly burly Weepah sump, places a measurement on the claim he staked

shallow pan about two thirds full of ' pay dirt.' Then he holds it in a stream and shakes it in such a way that the water carries away the lighter material leaving



Pitching a tent on the road to El Derade: Gold serbers who have raced by automobile to the remote corner of the Nevada detect, restent up before starching the barren fulls that may give scalery to their dreams of woulth

the gold at the bottom. The gold is finally recovered by further washing or jumming out." The pan is used now only in prospecting.

radle" used to wash "pay dirt" in larger quantities. This was a box, mountained on rockers and fitted with a perforated bottom of sheet tron. While water was poured over it, the cradle was recked, causing the pay dirt in it to sift through out to an incime stripped with bars of wood called 'riffles," to catch the gold.

IN LARGE scale placer workings the most effective methods have been slutening and hydraulic manny. The slutening shallow inclined trough through which a stream of water is directed. When the pay dart is shoveled into the upper end of the

trough, the gravel is carried downstream, while the heavy gold setties and accumulates on the floor of the trough, which is laid with rifles. Hydraube numer, or noning by water pressure, is used to recover free gold from large gravel heds. Powerful streams of water tear away the gravel and carry it into stuters.

hor working gold bearing river heds, large tracket designs have been used extensively in the West

The gravel, dog by the dredge, is put through screens, and the finer material passes to aluce boxes provided with rifles.

In these last three processes mercury has been employed to aid in capturing the gold by amalgumation, the mercury later being removed by distillation.

Dry gravel beds where once a civer flowed are the chief biding places for those treasured lumps of gold—nuggets—which are the dream of every prospector. One of the most famous of them the "Welcome Nugget," was picked up at Ballarat, Amstrona, half a century ago by a penaless fortune buster. It weighed 185 pounds and was valued at more than

\$50,000. The largest nugget ever reversied was discovered at Hill End. in New South Wales. It was about five feet long, three feet wate, and four anches

> 1 mark and soul for \$148,000! besentists believe nuggets have been formed by the massing together of sinaller grains of gold in the rough and tamble of time. In placer deposits the richest treasures ordinarily are found at the bottom of the gravel bedardose to the biskrock Sometimes, when the gravel beds are unusually thick, shalts and tuppels most be built to reach the hest pay dirt. These are known as tunnel clauss.

> As alluring as nuggets are the fabulously rich virus occasionally opened up in the quarts deposits. The 'lucky strike' at Wespah is a shining example. Here is a district that has been mined, off and on, for

Continued on page 138)

An Amazing Vision of the Future

Scientist Foresees a World Run by Radio





By ROBERT E. MARTIN

HE present is only the very beginning of an age of discovery-and the next century will mark the greatest advance of estiluation in the world's Su says Prof. A. M. Low in his new book. "The Future," a tale of wooders sur has no farry tale ever presented, of the regreels sevence has in store for the future Professor Low, British seientist, depicts a future more fantastic than anythma most of us could imagine.

The typical man of the future, he thinks: will be called by a radio alarm clock in the morning to take a few moments' radalight treptment of massage. Then he will pump acto has synthetic felt one piece ** He will wear his hat annost continuous because everyone will be bald. He will have to watch out lest be put on his wifele clothing by mistake, for men and women

will dress naucet make.

During brenkfast a loudspeaker will 1-4 but of news events, and he will watch some of them as they occur on a television screen. By altering the wave length, " can hear the kind of news he wishes. His breakfast may come from the communal kitchen by tubes. Telephone messages that were automatically recorded wildhe dept will then be read, and so too will the news received on his radio tape our

This business man of the fature trarig to life office in his car, will get in too. with it on the way by radio and dietato a pocket da taphone. An elevator carry the ear to his floor. All other his rigs will have moving stairways. I've streets moving sidewards and the street in a rigidious. Most of his travel will be by ar, and he will weekend on

Africa or Australia.

The world ac lives in will be unitely careter Duan it is lodgy for notes with have to be claiminged before long. Already there is proof. tast none ruses the temperature of

a room and has a destructive effect upon medigarsm. Even morseess subways not be atturned. Professor Low says; London already has a type of underground transat which you can hear a watch tick, the ears having ashestos-filled roofs, special windows, and hoods over the wheels to deflect noise.

THIS soundless world may be lighted at night by rame oscillation, for wire less has many of the characteristics of light. There will be stations to broadcast light, which all buildings will tap as re-

Future man will carry a pocket ratho set everywhere he goes, and television will make long-distance business conferences possible. It will also make it possible for

runge of apreed.

schools to link up, bearing and "seeing" the same university lecturer at the same time and following the lecture by diagram. upon a wireless-controlled blackboard

F pre man

In its earlier stage of development, as Professor Low visions it make power will he distributed locally from cables under the principal roads, and velucles will pick up the power through their motors. Factories will be built in the country and run by power broadcast from huge sta-

But all this is nothing to what may be

accomplished by control of the elecrouse emanations. "If matter is the result of defined electric vibration," Professor Low asks, "could we not transfer our tables, our clours and ourselves, in effect, by a knowledge of the forces which produce these oscillations? harder man may watch a bale of goods being whirled through space from Europe.

to South America, traveling, so to speak,

under the own power?

S FOR the automobale, it will give man service and theils that the automounderly today does not dream of. It w. be a stream-lined car with flexible find a melosed in flexible glass, with fone or a disk wheels inrouded. The aterior will be air-costoned. The engine will probably be of a gasoline steam turbone type, totally areloaed, and will not have to be tinkered with more than once a year. Eventually, power for vehicles will be tapped from the air by beam-wireless at any time or place.

Some day, too Professor Low predicts, there will be a wonderful Peganna vehicle, so acrocar, that can fly as well as ply the reach. It will be equipped with a ratio telephone and londspeaker, a milometer, us unometer, barometer, averometer, spessiometer and thermometer. Control Fruments will be easily operated with a nght touch and gene changing will give way to automatically variable gears or to ringmes which can give power over a wille

Chemistry's great immediate future will be money the crew of promocidistrilegensam Prof. Low sees no doub! If at we be able to construct synthetically

> more and more materia's used in everyday life today as direct products of nature.

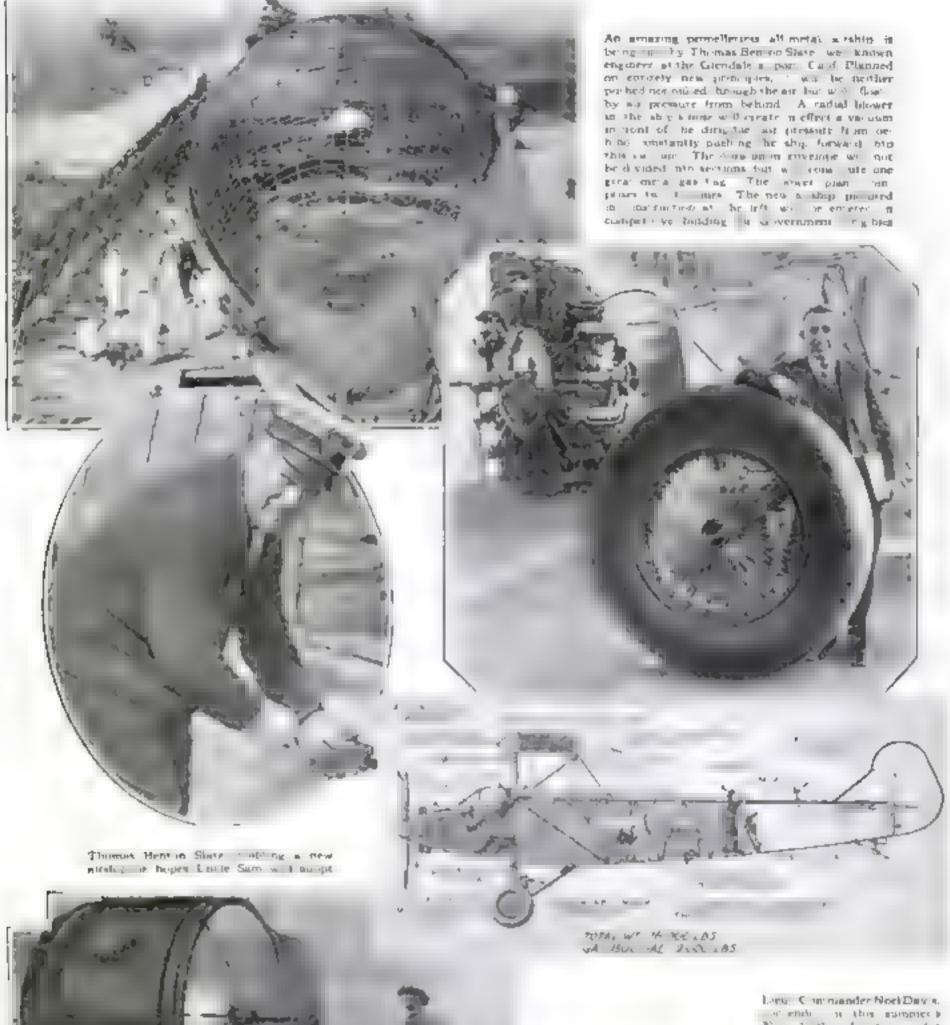
Greatest marvel of ad perbans, will be the transfer of power to the Earth from other planets. This is quite passable Professor Low

the sas, and he sees not ong funduations the - a of interplanetary communication I signals from a super-secrebigit beam thrown by ten thousand gunt calcium flures and reflectors, developing a 1, 4 of two mulion billion candlepower, might spain the 35,000,000 index that separate Earth and Mars when they are nearest, or it may be done through wireless, for the most powerful transmitting station. is believed expuble of reaching the Moon-

"It is far from fantastic," he says. to believe that an our near feture as knowledge of this wooderful force inproves, it may be possible to span the distance by sending directional waves or comtreations of waves, of enormous strength

There is no hout to the adventure of mea into the terrific realing of science"

The Progress of Aviation



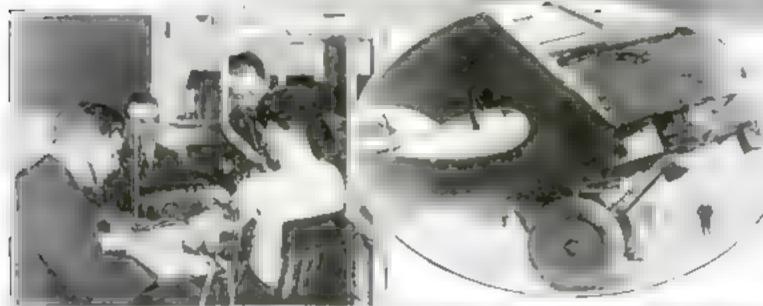
Called the world a largest land sph in see has gant land on at Mil Valerien, note Para ya tes arrownes at right on he London Marar les larte route. Re vots ng beams from sta twin see area a lanf feet tebricos are ver ute morely miles away and he oght of a topom modies a through sut from them through space.

The Commander weet Day at the Now York of a star are for the S 2000 Oriely made as a first above result the large when to be until in the date. From who as she had the giant for whom Partification being the first late. A most abuse of feature is the bage good he tank britising 900 gaussian carries to the fuscing colors on entil in the fuscing colors of bring divided, as is usual with large planes. Thick wings give he junior ustands) to being power.

Californian Builds Propellerless Dirigible—Latest German Super-Ship - Ninety-Mile Beacon for France—Other Advances

At again measure once a Commercial and head to the commercial and the





Left Pinner! It may be high a on the Junkers quarter and tright dated may. The come we get a few years and the accounts age of tribby thank may be expected as a long as even and many of 16,000 at all

A ve war are it a fravey entre stag to the stag to the

Pate for an analysis of the grant of the gra





The Lexington newest American explane carrier, receiving a coat of bartlesh p gray at the Fore River shappards. Quancy, Mass. Two new airplane carriers will be added to Buck Sam s

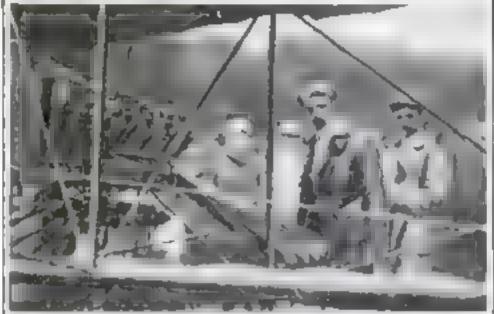
navel defence forces with the completion this full, at the Force R ver yards of the Lexangton and the Saratogle Both the thips will be equipped with the latest landing and take-off devices

How Sea Flying Was Made Safe



The first hydroaeroplane—Shipto-shore flights—Other triumphs of Glenn Curtiss, air pioneer By

FRANK PARKER STOCKBRIDGE



Oliven Curtise landing in New York City after flying down the Hudson from Arbany. He covered the 152 miles in two bours and fifty-one minutes, one of the most agrificant feats recorded in this series of articles, the fourth of which is on these pages. Above, photon of the Langiey medal, awarded Curtisi in 1914.

NTHUSLASTIC delegations met Glenn Cortiss at the pier when he returned from Europe. His victory at the first international avaition need in France had fixed hou as a national hero.

All America now wanted to see bun fly. Scores wanted him to but il flying machines for them. The Curtist Company had been enjoined by the Wrights against selling arplanes. Curtist had to get money to fight the patent highlighton. The quickest and essiont way was by giving exhibition il ghts.

That summer of 1909, the city of New York staged a

double celebration, the three hundredth anniversary of Hendrik Hudson's discovery of the river and the centennial of Robert Fulton's voyage in his first steamboat. The promoters planned a great procession up the Hudson. Replicat of the Half-Mona and the Clermont were to be convoyed by a feet of aircraft. Popular imagination, fired by the amazing things already accomplished in the air, leaped fifty years beyond possibilities. Tremendom was the disappointment when the airships failed to perform according to promise

Glenn Curtus, keeping a promise which he had made before sailing for France, took a plane to Governors Island in the upper boy, and waited for favorable

winds.

A CANNON shot was to be the signal for the start of his flight. But so may y annions and bombs were being fired that few paid attention when, at and he made a short flight in the direction of the Statue of Liberty and returned to Governors Island. He had an engagement for an exhibition flight at St. Lows and had to marry away without competing for the prize of \$10.000 which the New York B orld had offered to the first airman to fly over the route of Hudson and Fulton, New York to Albany, or in the opposite threetion.

A few days later Wilbur Wright flew his place several unles up the Hudson River "That was really a magnificent flight, considering weather conditions and the stage which flying had reached at that time. 'Glenn Curios said to me. For exhibition Highta Curios devised

a "knockdown" amplane. The wings came apart in sections. Everything packed into compact cases be could entry has plane an personal baggings anywhere. This was the machine he took to St. Louis, where tens of thousands any an amplane in flight for the first time and cheered the evolutions of Captain Took Baldwin, Roy Kantienshire und Lincoln Benchey in their Baldwin-Curtiss displacement.

Then to Lon Angelea, for the first international flying meet ever held in America Louis Paulian was there for France Ciet sy and his first pupil. Charles F. Williad, whom he had taught to fly at Mincola, were there

New records were made for crosscountry fiving, for speed, for allitude. Loris l'au-ban flew higher than anyone had ever gube before—1,165 feet

Tills was in January 1930. Glenn Curtiss got off the ground in six and two fiths seconds after a run of only a nety-eight feet. He won \$6500 in prizes, for speed, for endurance, for getting off the ground in the abortest time. On April 10th at Memphis he chipped three fifths of a second off his Los Angeles starting time. At San Votonio, on April 23rd, he lowered that another tenth of a second. The next day, in the same place, C. K. Hamilton, one of the first of the Curtiss galaxy of flying stars, got off the ground in less than four seconds, with a run of only seventy feet.



By the beginning of 1910 there were ten amplanes at once going through the Curtus works at Hammondsport, Quantity production! Dozens of young men were learning to fly Willard, Hamilton, J. C. Mars, who had been a halloon man with Capt. Baldwm, 1 neolu Beachev, Eagene Ely, C. C. Witmer, Lansing Callon, "Gink" Dougherty and others who later wen fame in the air, joined the Curban extension forces. To teach them to fly, Curton invented the "gram-cutter" az amplane with the wiege ampulated so that it can d not rue more than a foot or two. Pupils

practiced with it until manipulation of the controls became automatic,

In the three years following the crowning of them Curtiss as king of the nor at Rhemos, more than two thousand exhibition flights were given by his pupils and burse for the neither sold the planes to those exhibition flights nor employed them. The first would have further complicated the parent litigation of the Wing its while the second would have made into hable for dainages in case of account. He tanget main in to fix, then leased the machines to them, they took their own rises.

Extra buxardous risks, some of them, portendarly the atoms which Lincoln Brackey insisted on trying. The newspapers reported that a Frenchman had looped the loop with an airplane; nothing would do for Beachey but to try it burself. What would happen when the rugine turned upside down and the gasoline leaked out of the early retor? That worned Carl as.

"I CONFESS I don't know yet why he dodn't set his machine after when the gas flowed down over the hot engine." he said to me, "but somehow Beachey got away with it."

He was the dare-devil of the Curtiss flyers. His exploit in flying down the Nugara Gorge, over the boiling rapids, through unknown and treacherous air currents, was probably the greatest risk ever taken by an airman. Spray from the Falls, drawn in through the carburetor, fouled his spack plugs, and the en-

gine was bitting on only an occasional cyander when he findly landed. The crash that ended his life a year or two later was mevitable to one of Beachey's

temperament.

Wealthy sportsmen were beginning to buy airplanes. Curtus first private customer was A. P. Warner of Beloit, Wisconstn, inventor of the Warner speedometer. He built an acrial speed gage on the principle of an anemometer; four bemispherical cups, revolving on the ends of a Greek cross, the familiar method of measuring wind velocity. Warner gave one to Gienn Cartus to try. One of the cups flew off and but Curtism in the face. He silvised Mr. Warner to try another acheme.

Curtous had not lost aight of that \$10,000 purse hung up for a Hudson River flight. Nobady had got it in 1009-the prize was still anybody's. All that spring of 1910 a new machine, specially designed to win the World prize, was going through the Curtiss works at Hammondsport.

In May Curies put pontoons on his new place, flew around the Hammondsport valley and lances safely on the waters of Lake Kenka. The first hydroacroplane! Now he could undertake to ils the length of the Hadson River with assurance that he would not be drowned if I is plane in led.

HE SPENT days preparing for this dignt. Searching for landing places along the route where he could descend for gas and it or in case of accelert, he stopped at Porguer, see, latway between New York are, Abany Here Le. found a splended sor, on the grounds of the State Hose tal for the lesame.

When I told Dr. I'my or the supermlet leaf final [interaced to star beginn my way down the root in a dyag macame be said, very positely Why erriative Mr. Circless, come right in here, here's where all lying innel me inventors and 'Curtiso tells, chucking at the renth scence. That was the attitude, still, of everybody who had not seen an

airplane flying in the air.

His plane, the Hudson Figer, was set up on Rensselaer Island, between Alhany and Troy. Crowds came to see it. All the great newspapers sent reporters. The New York Times chartesed a special tram to race the amplane down the river whenever Curtus should start. And Curtiss wasted.

ON THREE different mornings he got up at daybreak, ready for an early start, then decided there was too much word. He pat in his time with his mechanics, turkering while the impationt newspapermen openly accused him of being a faker. Editors all over the country printed gibes.

At last at down on the morning of May 30, 1910. Curtiss announced he was ready. The reporters flashed the news to their papers. Holday crowds ined the river banks-and Curtiss didn't start! The weather at Albany wesline but the telegraph brought reports of strong winds blowing northward up the river. Hy nightfull of that Memorial Day the to we spapers and the public were conversed that nobady world ever even try to the

down the Bustson. Then, the next day, Senday merang, Glenn Curtos started

ort and did it.

I was getting as tired of waiting as any books a be," he told me.

If was just after eight when he rose rotothe nor 11 has was called his motor running perfectly. The special framstarted as he did slipping down the waterletel tails of the New York Corte Unti-

r tri Hoara 1 1 1 1 1



Circling the Statue of Liberty at the finish of the Albany New York flight. Curries had put pontoons on this plane, producing the first hydroseroplane

but the flyer beard nothing but his motor exhaust. He flew over the Por glikeepase bridge, 150 feet above the rails, then circled eastward to a landing field at Camelot while the possitation stood on Julisides and roof tops and observed. Down to a safe landing and nobody there with gas and oil as he and arranged! The man entended with the job of providing firel and labricant did not believe Curton was ever conang.

CEVERAL motorats volunteered help. oned in a few asportes, with tank and erank case replensived, Curtist rose for the second leg of the great flight. Even at that point he had already won the Scientifia American trophy for the fined

time, with the longest continuous flight ever made - eighty seven unles, from Albuny to Poughkeepsie.

Approaching the Hudson highlands, Curtiss had his first experience with "holes in the air that carry the plane downward revealably, occasumally taking a flyer safe as toll

The air boiled like a gigantic teakettle, erom currents, upward currents, downward currents, that let the airman fall until once he almost touched the water with a wing tip. Sudden drops of a hundred feet that seemed like a thousand. No man ever had tried to fly through air like

But in a few seconds the placed expanse of the Tappan Zee lay below him, the hazard passed. Crowds on the river (Continued on page 141,



Facts Everyone Should Know

These Fifty-Eight Questions Offer a New Way to Test Your Stock of Useful Information

HOW large is your stock of useful information? Have you learned the secret of selecting valuable facts and figures from the general run of information, and of sorting them in mental pigeonholes for future reference? Or have you allowed knowledge once gamed in school or elsewhere, to escape you through neglect or disuse?

pasteurization

The four fascinating tests given below will tell you. They were devised recently at Columbia I inversity as a test of general knowledge of science.

At first glance, the tests may appear difficult, but you will see that they have been samplified by the fact that in each case a list of the answers is given at the outset. All you need to do is to fit the

Bememer converter

various answers into the correct spaces.

There are fifty-eight questions in all, including the dates of discoveries and inventions. If you answer thirty five of them correctly you may be reasonably sure you are "well informed." If you score more than thirty-five you can put yourse f down as exceptional. The correct answers appear on page 139.

Terms Used in Applied Science

THIS test will measure your familiarity with terms of applied science. See how many of the following ten terms you can place correctly in the spaces before the numbered statements.

fünment

THE PROPERTY ENTO-48 abilizer cyanometer cachuretor. Ammeter. redimentivity mercount mark ... 1 The rotating part of a motor or dynamo. _ 2 The fine wire in an electric light bulb which gaves off light. 3. An instrument for mixing assobne and air to form an explosive mixture 4. An instrument for measuring electric current. 5. A vessel for bolding molten from and changing at ento steel. . 6. A rotating machine which derives its power from water or steam. . 7. An instrument for measuring the color of the 8. A huge spinning top used to prevent rolling of ahips at sea. The property which some substances possess of giving off invisible but penetrating mys.10. The process of heating milk to destroy bacteria and prevent souring.

Great Inventors and Inventions

HERE are the names of twelve inventors and discoverers, and the dates of their important achievements. In the space before each of the twelve numbered statements write the correct name, and at the end write the correct date.

Isaac New Elias How James Wat Thomas Es	: S	eorge Wes amuel P E lexander C yrus McC	Bell	Olaus Ro Gelileo G Richard I Johann I	lables Getling
	1609 1876	1834 1675	1759 1845	1893 1609	1861 1868
Inventor 1-	Invented	the first	ниссемб	al steam	Date
3. -5. 6. -7. -8. -9.	Invented Formulate gravitation invented furst mea Discovere planets Invented Invente	the air br. sured the d the law the newing the crape: the trieph the machi- room to n	ig picture law of speed of h a of motio machine ione ne guo	ght on of the	

Your Mental Measuring Stick

HOW accurately does your mand serve you as a measuring stick? Try to place each of the following twelve numbers in its right space before one of the statements below

.000039	5715	660	6.080	
.4	231	2,204.6	43,560	
6	540	5,280	6,000,000,000,000	
1.	Number o	f feet in one mile.		
2.	Number o	Number of pounds in one metric ton.		
3.	Number o	aber of acres in one square mile.		
4.	Number 6	r of square feet in one acre.		
5.	Number o	f degrees in one n	idian.	
6.	Number o	f inches in one cer	if imeter	
7-	Number o	f feet in one knot :	one nautical male).	
8	Number o	f mehes in one mi	eron.	
9.	Number o	f sules in one ligh	t-year	
10.	Number o	of cubic inches in t	me gallon.	
		if feet in one fathe		
12.	Number o	f feet in one furla	tuż.	

Remember These Measurements?

If YOU are familiar with the different units of measurement, how widely can you apply them? See how many of the following twelve numbers you can place correctly in the spaces.

29.5	62 5	1,100	239,000
39 -	256	25,000	93,000,000
29 [4]	459.4	166,000	
		6,000,000.00	10,000,000,000,000

1 Number of miles around the earth

Number of feet per second sound travels in air
 Number of vibrations per second of middle C on the piano.

4. Number of miles from the earth to the moon.
5. Number of degrees below zero Fahrenheit of

absolute zero.

6. Height of barometer in inches under normal

Height of barometer in inches under normal conditions.

7. Number of miles per second light travels.

8. Mass or weight of the earth in tons.

9 Destance in males from earth to nun.

. 10. Length in inches of a pendulum that beats seconds.

_11. Weight in pounds of one cubic foot of water

__12. Height of world a highest mountain in feet.

Is There a Human Speed Limit?

Noted British scientist's remarkable experiments with athletes have revealed many amazing new facts about the mechanics and chemistry of running

By ARTHUR GRAHAME

dock, the Calsfornia spenter famous as "the fastest human," not so long ago ron 100 yards in 9 5-10 seconds, he established a new American record, clapping one tenth of a second off the mark set by Arthur Duffy a quarter of a century ago. To do that, Paddock had to run at an average speed, pistol to tape, of 10 ½ yards a second. In his strate, he must have been stepping about twelve yards a second, which means that he was travel-

much means that he was traveting at the lively rate of twenty-four and one half muss an hour.

In that the speed limit, or close to the speed limit, of the human ranner? Do the remarkable resords of sprinters such as Pacifick and R shoul Locke, and of middle-distance conners such as Narion and Fetsia Wale, represent the utmost in speed and entergree of which the banoan may one is capable? Has stern and rules ble Nature established speed laws what a even the greatest of almetes may not break?

Science is answering these questions. Prof. A. V. H.I. noted langlish physiologist and winner of the Nobel Peze in measure in 1922, lines perfected a method of enabling in in to measure the characteristics of an affecte in respect to expenditure of energy and to calculate I is

speed for a given distance. His predictions are based on stades of the effects on the human mechanism of violent effort and of fatigue, which, in comparation with an ingenious tuning method, may result in proving that in some of the shorter mining events the best at detes have come so close to the human speed limit that future record breaking is likely to be in hundredths, rather than fifths or tenths, of a second.

THIS timing method, offering a degree of accuracy impossible with a human timer and the best split-second watch consists of wire coils placed alongside the track at the starting line, at the finish and at intermediate points. The manner carries, attached to his waist by a tape, a small piece of magnetized backsaw blade, and when he passes a coil a current is induced in it, and a galvanometer attached to the coil is deflected. These deflections are recorded on moving photographic paper, marked in units of time, in a special type of camera. The



Professor A. V. Hill, noted English physiologist, winner of the Nobel Prize in medicine in 1977 and recently noncondent lectures at Cornell University. In his remarkable studies of the human muscular machine, he has perfected a method of timing runners which, in commedical with other discourries, has changed the human speed limit from a topic of circles track argument to a subject for serious screening discourses.

start in recorded by pressing an electric key at the moment the starter's pistol is fired. The tuning stips provide a detailed and rassey understood record



A man, running 100 yards in the second time of ten seconds. Perfernor Has a experiments show, does as much work as would be required to lift him 300 feet in the sar. He must up 9 horsepower of energy. He generates 1% ounces of lacre acid (mancle firtigue). And he "runn into debt" for five to seven quarts of oxygen. An athlete a naygen borrowing capacity is a reliable index, seconding to Professor Hab, of his ability as a runner, more especially in distance events

of the athlete's performance, even showing when the runner "beats the gun" by about a tenth of a second.

When I visited Professor Hill at Cornell University, where this pring he has been a nonresident lecturer in chemistry, he was conducting experiments on a small outdone training track. Timing coils were placed at the starting line, and one, three, six, ten, lifteen, twenty, thirty forty, fifty and sixty yards from it. The emerior ats showed that with all the menters exampled it took, at the start, about one tenth of a seemed for the romer to flash the order "go" from as much to his muscles. A runner who did the sixty yards in 7 and 56-100 seconds reached maxinorm speed at some moment between twenty and thirty yards. which seems to be the case with alsprinters. His last ten yards as a whole were the fastest. He covered them pr 90, 100 recond.

A runs er 'Professor Hill explanted it subject to a retarding i dustice proportional to his veneity. The faster be runs, the greater the resistance he must overcome. In effect it is the same as when a randrop facts through the nor, the resistance of the air grows greater as the speed of the randrop in

"The sprinter who san sixty yards in 7 and 50-100 seconds exerted a constant force of about eighty percent of his body weight. He started with an initial acceleration equal to four fifths of gravity. In running 100 yards he would do work equal to that required to left his body 210 feet in the air. Another runner exerted a force equal to uncerv-two percent of his body weight. In running 100 yards he would do work equal to that required to bit hinself 276 feet in the air.

"A SPRINTER capable of running 100 vards in record time would perform work equal to that required to lift hunself 300 feet or more in the sir. In running 100 yards in ten seconds a man uses into horsenower of energy

The tremendous expenditure of energy supplies accentific basis for the belief, expressed by many prominent track coaches, that, when the present sprint records are besten, it will be by fractions of a second so small that they can be recorded only by electric timing apparatus.

"Muscles contract and relax rapidly

when a runner is traveling at high speed," Professor Hill then conimued. "Lactic acid. a product of muscular intigue, a variety of the seid that accompanies the fermentation of milk-is manufactured at the rate of three or four grams a second, and our god one ha f ounces of this comparatively strong acaz in the mascles at the eral of a fast 100 yards will remilt in a considerable follog off in speed Four pances is enough to stop the athlete completely.

"A runner traveling at high speed : say leo yards a second must pay a tremendous price in energy for even a alignt merease in speed. At high speeds

NEXT MONTH!

Every man thrills to the clang of the fire engine, but fire fighting today is a science that every one of us should know more about. Modern technical knowledge and the hardgathered wisdom of experience are pitted together in our

"CHIEF OF BATTALION"

By KARL W. DETZER

to appear in our July issue. It is a thrilling story of life in a fire department today, that you won't want to miss.

> ecords. Once a sprinter has altoin d his maximum speed, the remaining distame to be run is so short that it is difficult for him to increase his speed greatly

> > For these reasons I not think that trace will be any star inclowering of regulate in the spiral GE THINKS

La bise league

a muscle must burn up carbohydrates, and to do that it must have oxygen. But it is not necessary that this oxygen should come directly from the outer or The muscles store up energy as a storage buttery stores up chetricity, and can use stored energy as an cleering motor uses stored electricity. They are a le to horrow' oxygen, and replace st after the effort has been made and the athlete is resting

"In the sprints the pthlete runs almost enturely on stored cuergy

and breatling is of slight importance. The distance or so short that he is mable to use up all his stored energy and so exhaust lumself. In the longer roas the athlete's ability to borrow oxygen and repay it later is index to his ability as a EUG OCC.

It take been determined by experithe stat the max mam oxygen intake of a resour is about three and one half quarts a punute, and that the maximum energy storage capacity is equivalent to about flurteen quarts. This gives him a total oxygen expacity of about sixteen and one bull quarts. An athlete running at top speed can use up all his available visces in a little more than 800 yards. When he has done so total exhaustion is

at band." I asked Professor Hill how he, as a physiologist, had become so deeply interested in athletics.

"MANY people ask mo "Well, the physiologist's job is to study the chemical and physical activities of fiving organishur—muscles, heart, and so on, He studies, for example, the curious power a muscle posacrees of adapting its liberation of energy to the work it has to do. In the marvelous performances of trained athletes he can obtain data of extraorduary exactness. Recently an athlete ran sixty yards for me, four times in succession. I had asked lum to try to run at the same speed each time. His times were taken at ten points along the track, and the average difference in his times was only 14-1000 second! If I wantest semilar data on and isteral fatigue, where could I find a bricklayer of sutherent powers of coordination to

lay beicks with anything like that regularity of performance? The precise data that may be obtained from the performances of athletes cambles the physiologist to place but subject on a level with

the exact sciences. And to obtain this reliable data, extreme accuracy in timing instruments, of course, is absolutely essential.

First b that - b after should rait for ark of the few arms prix be determined by his over in Gor town and company of a Lowerberarwork The close of a needle of special of feeding to Program : I work thank It he has been exting Carnell 1 yeary carners Vere pured in the wall along the rack. The terthe attended to make the state of the e ii an ii sa ii arreni iii or the materials bring grandle odly se in terriors in this. The has metood exist in the best means of a numerical nine from the five home with two per mil-1 thest of the meeting all events dea first by the a seles of absorbed by rten 11. Unly a mual part is n a lable to the section's foreard

School States of the portrait for or the appear has seen to for poor coordinat a resides in an trightly large production of last cased and consumption of oxygen, with consequent loss of speed

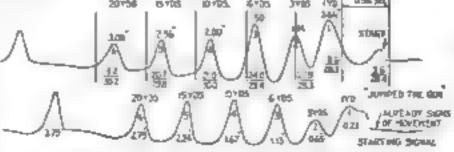
'It is improbable that athletes of the future will be able to improve

greatly on the starting speed of the present record holders. The strain on muscles and tendons already is fremendans. In the visce is clustic properties of our muscles Nature has provided a safety valve for the athlete determined to break records. The mevitable fading off in muscular tension that is the result of violent physical effort keeps him from week-

ing the mechanism of the

body in his efforts to smash

The start is seconded electrically, the resulting graph, at shown below, showing more accurately then a human timer and a split-second watch whether the runner beats the The photo shows Jack Moskley (left), Cornell track exach, starting quintant track couch Bange, who is corrected magnetized steel steep tied around his wast holds an electric switch in his hand, which aignals the start

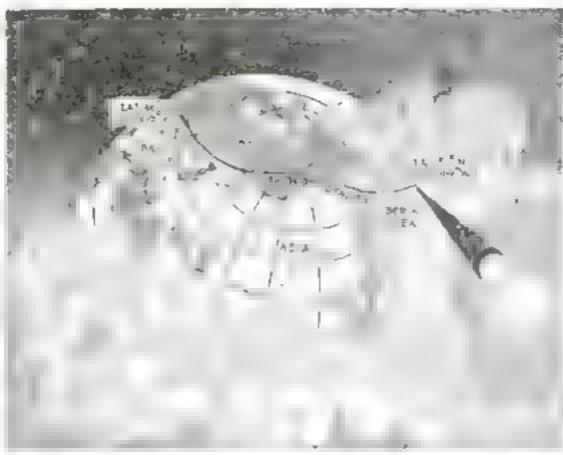


Irregularities in a runner's start are readily detected by a study of the graphs produced by Professor Hill's timing apparatus. These records showed a currect start (upper curve) and a "numping the gum" start.

Sun's Next Eclipse on June 29

STRONOMERS A from all over the world are gathering in Norway to view the total eclipse of the sun that will occur early in the morning of June 29. The United States, where memories are still vivid of the eclipse. of January 24, 1925, is to send at least one party to study the cel pse the McCormick-Chaloner expedition from the University of A programme

The June 29 eclasse can be viewed a Wales. England. Scandings a and Suberia. It will be the first total celepse visit le in longs land in 200 years, Specia trains will accept the country, where, a few number after aim ase, they will see the



Path of the total solar colline to occur June 29, when the moon will pass between sub and earth. Traveling at fifty or ica a minute, the occurs a thinless will start the colline on the Aranta Ocean at sum or aware prepare Britain, up Normay, rate the Arctic Ocean and through Science. It teners the earth at sumes, having taken two hours to fit across the earth

sun blotted out for nearly half a minute.

Three other cobpses are scheduled for 1927. The first, a total colpse of the moon, will be visible throughout this country early in the morning of June 15. Another total colipse of the moon and a partial colpse of the aun are due in December.

Scientists find their reward for eclipse expeditions in studies and photographs of the sun's outer atmosphere that could be made at no other time. The American expedition, for example, hopes to reveal new secrets of the invoteració chejes icid element (coronino." Has far detected only due rig total ecopses in the hot gases surrounding the sun.

Great Hudson Tunnel Undergoes Health Tests



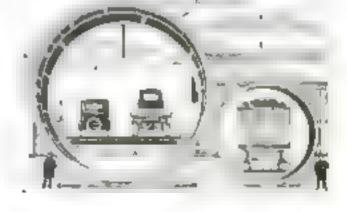
Watching a ventilation test of the under-Rudson tunnel, made with anothe bombs

THE ventilating system installed in the new Hudson River vehicular tunnel connecting New York and New Jersey has been, perhaps, the most important of the stopendous problems involved in this great engineering feat. If the ventilation is not adequate in a tunnel designed to carry motor vehicles, there is a possibility of serious injury to the health of drivers using the tunnel.

To solve it, the engineers abandoord the usual scheme of forcing air in at one end and sucking it out at the other lustrad, they made ingentous use of the space at the top and bottom of the rareular tubes, as shown to the drawing at the upper right. At frequent intervals along the tunnel, fresh air is forced in from a duct beneath the readway. Impure or and the deadly carbon monoyale gas produced by the running motors are supposed to flow into the upper duct and out of the tunnel by way of enormous stacks in the ventilating buildings, one of which is shown at the right

Smoke bombs and smoke candles are being used to test the flow of mr in the tunnel. By this means it is possible to get visual proof of just how rapidly the ventilating system will remove the exhaust gases of motor vehicles.

At this writing several tests have been made. Engineers are now checking the results, and expect them to show the tube safe before it is opened to the public—probably in August of this year.





Ventileting building on New York side housing face that purify the tunnel sir-Above, the new tunnel 19th feet in diamcor, compared with Hudson tallway tube

The World's Progress in Science

On these pages are presented each month beref startes of scientific discovery and research having practical bearing on our everyday problems.

No "Crimmal Type," Survey Shows

THERE is no such thing as a "crimmal type we are now told. The average criminal is a normally intelligent individual and consequently our methods of pinishment which are based on the theory that he is a "Type" and not an individual, are documed to failure.

Such are some of the findings of the

most equapre reassive study of a turge group of cremina a ever undertaken when the personal and family lustory, environment and element teristics of 3.053 offensiera in the New York Coart of General SCHOLOGE Were strated recently by psychologosta: and playagians meeer toe supervoston of Edwin J.

Caosey, professor of cruminology at Ford-Lain University Professor Cooley who is also Cinel Probation Officer of the Magistrates Courts of New York offers the following conclusions drawn from his

investigation

There is no single cause or combination of causes for crime, there is no such thing as a "criminal type. The majority of criminals are of normal intelligence, not feeble-manded. Environment a one is not a cause of crime.

The real cause of crime, the investigation second to mow, is to be found to neglected and untraned youth. Of the 3.055 criminals studied, 44 percent were under \$1, 68.8 percent under \$1

Extension of the presistion system and segregation of nonreformable criminals are recommended in the report.

Relies of Ice Age Americans—?

ARCHAEOLOGISTS, degging into the soil of America, have recently come upon fascinating evidence that men lived on this continent far earlier than has been generally believed -perhaps a million years ago? This evidence gathered by J. D. Figgins and Harold J. Cook of the Colorado Museum of Natural History at Denver, consists of arrowbeads and other implements found buried with the fossil bones of extinct animals in antient geological deposits in Oklahoma, Texas and New Mexico.

The Indian is thought to have first come to America from Asia between 8,000 and 25,000 years ago. The newly found relics, however, are believed to date back to the great Ice Age when northeastern America was covered periodically with an impiense glacier and when prentsforic elephants and mastodons roamed the land.

Metrry bullets" that strug unstraid of kill and

"Mercy bullets" that stud material of hill we be used by Capt Barnett W. Harrin, of Chicago, to capture wild assimils. As amounthers within the bullets, which can be fired from shengun or rife readers the attitud temporarily unconscious. Two types are shown in the photo at the left

This was 25 000 to a nullion years ago. Minimues uncatted from the burnleaves of amount 'Basket Makers' in Amount who lived about 1500 BC. bobbed her hair. Her husband let his hair grow long, and branked it. Burned with

one prehistoric woman was the muriny of a small lap-dog!

New Anaesthetic Tested

Discovery of a new management advantages over ether or chloroform, in claimed by German surgeons. Known as "107" at has proved successful in 200 tests, according to Dr. Ernst I crab of Berba.

and blood pressure of patients are said to remain normal, disagreeable after-effects and darager to heart, lungs or nerves eliminated, and operations possible even in severe cases of preumonia and advanced inherentosis. Since it requires no inhabition mask it permits operations on the face, nose and throat. A bromine solution. "107" is introduced into the ritestines.

Rubber Chemistry Magic

WE SHOULD find it hard to get along today will is out tubber; yet its countless uses would have been impossible without the ceaseless work of chemists. Dr. W. C. Geer one of America's foremost rub-

ber experts, recently stated that the world owes a billion dollars a year to chemistry in the rubber industry alone,

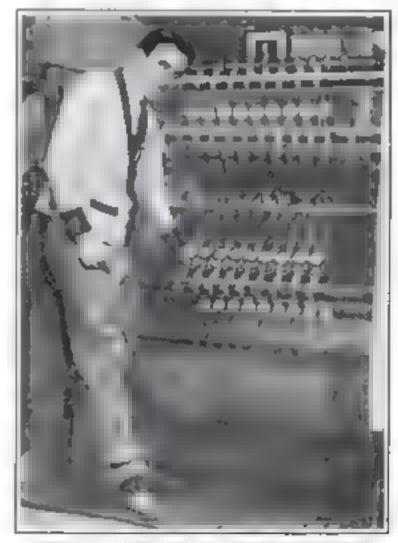
This billion is represented in the production of better rubber by speeder processes. Our automobile tires, gost balls, garden hose and gloves last twice or tarre times as long as they used to New chemical processes have almost entirely cared the tendency of rubber articles to become hard and dry with age. In fact, but for the chemists, says Dr. Geer, the world's aupply of rubber would have been exceeded long ago by the demand

High Wages Boost Inventions

INTION of labor-saving devices
to indistry to being more than ever
attinulated by the nicrease in the supply of chenp abor? in this
country, sava Prof. Ribert
D. Ward, of Harvard University

'From one end of the country to the otter, reports of new labor-saving much nery arc coming in almost dady. New coke-handling apparatus, mechanical brick makers, track layers, and tumberless of icr machines are replacing crude hand labor and at the same time saving money. The question, 'Who will dig our difficies?' is answered by mechanical difficulty digers, the largest of which can do the work of four lumbered.

The rapid development of new machines to do rough work is not only decreasing unemployment, Professor Ward



Tests are still being made to solve the mystery of the destruction of the dirigible Shanandnah. Above is a machine devised at the Bureau of Standards to test girders made by the same process as the Shanandnah a, to descover whether structural makeoms caused the mishap

"Mercy" Bullets for Animals—Alcoholism in Rats -Dancing Measured in Calories New Anaesthetic, and Other Discoveries

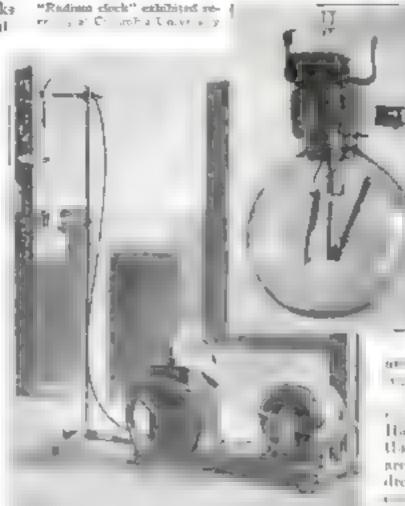
finds, but is smoothing out the peaks and hollows of seasonal employment. He prophesies that the new industrial artistion, while increasing labor costs, willnevertheless lower production costs.

Twins Alike Even in Unlikeness

NO TWO things in the world are exactly make, we are often told. A close approach to depheation, however, is found in the case of "lentical twinst that is, twins believed to have grown from the same feetslured egg cell, as distinguished from ordinary or "fraternal" twos. Recently a Japanese biologist, Dr. Taku Keenai, reported the results of studies which show that in some instances Iw is a builty may be more like each other than are the two harves of a single policy bond. For example, the right lines of one identical twin reseru and the right hand of his brother rare closely than did the right and eft had note ther twin!

How Dances Burn Us Up

SCIENTISTS at the University of Helsingforn, Finland, have just completed interesting measurements of the energy tonso ned in daming, a terms of heat critic. The fast in asorka consumed the most fact =10.87



Response " tetle" the time, in this among new instruction. Within a vacuum both, an electrically charged gold loof in larges and each substitutely book and forth carb build from to place the maximum of the alpha tays of the rad um. A tout to substitute in internet with a motor direct pump.

calores no low for each k logrow of body weight or almost two of the energy construed by a stonerotter plying his trade loss polks required loss calories, for trot, 4.78; schot-bester 4 to while the waits used up the least energy 3.99.

Science and Conservation

REGARDING future development of natural resources Secretary of the Interior Hubert Work says: "Serence can help us find new wealth in materials trodden under foot as worthless."

A dirty yellow intered found on barren slopes of Colorado proved to be radium, boon to the suffering. Helium gas was fotusi in tratural gas from kansas wells. Today it is being used for inflating air-strps, for cooling electric generators and motors and filling radio tubes, in the treatment of disease; even to make toy ballooms safe for children!

Priceless wealth lies hidden all about us.

Blood Has Daily Tide

IN THE blood stream, pumped from the heart to give us life, there are daily tides, like the chb and flow of

the idea of the sea. Dr. A. F. Bernard Shaw, of New-castle, England, recently made this discovery while studying the white corpuscies of the blood. These white cells, whose duty it is to fight discuse germs which enter the blood, are known to vary in numbers from tune to time. Dr. Shaw found that the number increases and decreases in two regular daily waves.

The high tide of white corpuscies usually comes just after undrught, and again in the afternoon. Dr. Shaw suggests that these tides may bear some relation to the hours of eating

and hoping or may be due to chang

her strates thing just discovidea it our blood by Dr. W. M.
Its auch, German physician, is
that at ger makes it tern sweeter. He
aroused anger in human subjects, then
drew off samples of blood. In every
found more segar in the brood
me fit of creation that before
Now he offers it as his belief that
anger is part as way of preparing the
blood for combat. More sugar in the
blood for combat, supplies food for
the nums es to not youldy

Alcoholic Rats and Heredity

JEST because a person is descended from hard-crucking mores one or no significant he can "hold his higher" better than others for does it menume is more bedy to term into a ozonkant. Such are the conclusions of Prof. Frank B. Harson mit Miss Florence Hays of Washington Conversity. St. Lowis, Mo. after staging a series of drinking tests with rate.

In a tight box they placed ten rata, five of which were descended from ten gen crations of drunken ancestors and five from soler forbears. After saturating the art in the box with ancebox formes, the experimenters observed the time it took the anima's to keel over. Repeated tests showed virtually no difference in their renatance to the drug

More Antennas, Weaker Signals

AN INTERESTING new fact about A ratio broadcasting has been revealed by R. H. Barfield of the English Radio Research Board. It is this: The strength of a agoal received on your set depends materially on the number of other radio listeners tuned in. In other words, every additional antenna takes energy from the broadcast signal.

By testing waves received from the same station in various directions. Mr Barfield found that the energy, after passing over districts with many antennas, was noticeably less than after passing sparsely settled regions with few antennas.



Science now "hears" the atom, too. By means of this remarkable device, invented in Germany, the movement of millions of atoms in a bar of soft iron, when disturbed by a magnet, can be braid distinctly as a petition rouring



Science and Ingenuity Put to the Supreme Test

By HAWTHORNE DANIEL

CRUISING among the Aleutian Islands, from Scattle yachts men Parker and Thornton, partners in an engineering firm; Williams, a young paval architect, and Kelly a deck hand-were captured and imprisoned in their own yawl by Kiska Joe, murderous half-breed seal poscher. A shipwreek separated them from their captor, but cast them with Comak. one of Kada Joe's crew of native Azents, on the desolate shores. of Devi. Island. By killing game they supplied themselves with food and clotting, and my suching ore found on the island they made took of steet. A werd cry that echoed through the island rigsashed them, for they count find no trace of inhabit ants. They planned to build a hoat to be driven by a steam engine fashioned from iron ore. But just as they were beginning work on the boat, Kiska Joe's schooner appeared offshore. He had returned to search for them. When the poscher reached the beach in a small boat, Parker, overjoyed at the chance of rescue and acting against the advice of his comrades, highed to greet his former captor. He was immediately seized and bound. Aska Joe and one of his men, armed with rifles, then ndvanced against the other eastaways who lay concealed behind rocks at the top of a cliff. As Kiska Joe drew near, Kelly rolled a boulder down upon him. Now read on

A BRANCH snapped as the bootler fell and with the querk-less of a mountain goat k ska Joe leaped. He was none too soon for the rock crassed within five feet of him. Lien bounded down the ravine until it splashed into the stream. Even before it came to rest in the water. Kiska Joe afted his rifle and fixed four shots in rapid succession in the direction from which the boulder had finled. Kelly heard the builets spatter on the rocks before him.

"Well, he knows we're here," whispered Thornton, "He

may not come any farther."

But Kiska Joe was not to be frightened by a single stone. Again he started forward, keeping well to the other side of the

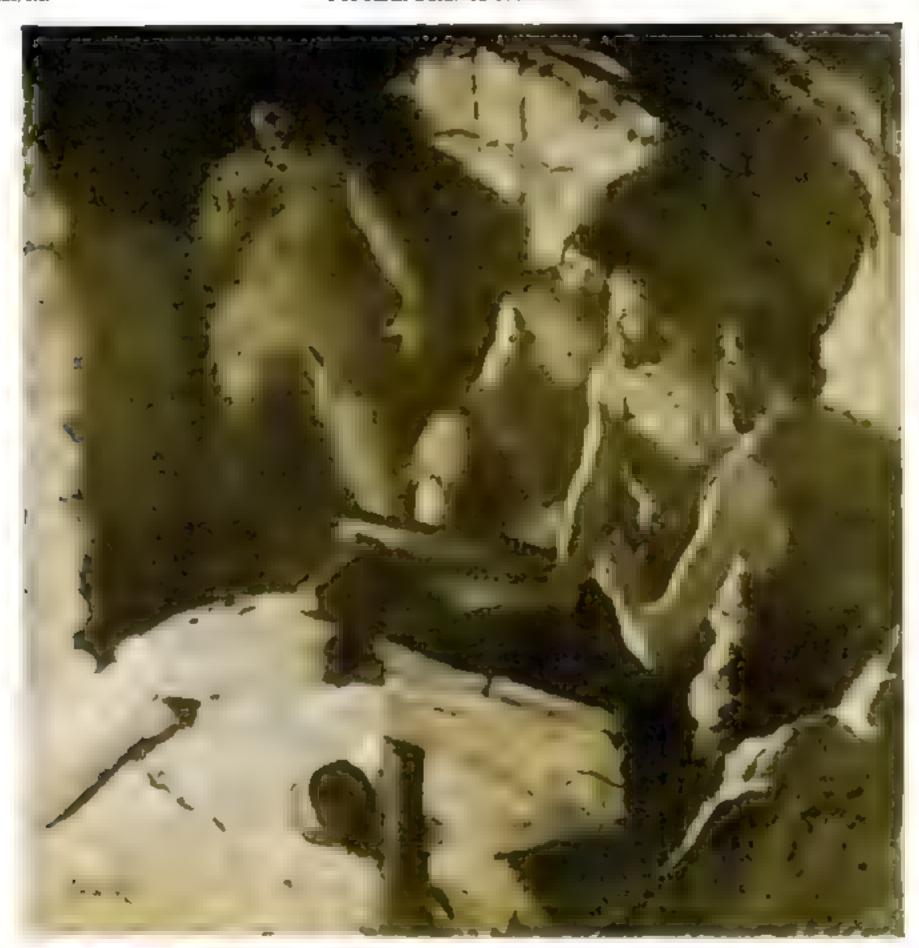
cavino. Thornton raised his head a trifle to see where their enemy was, and a bullet of pped the leaves close to his car kisks. Joe had dropped the packages he had been carrying, and now was ready to fire at any provenest he could detect lits follower, too, stood ready with his rule.

The group of castanase at the edge of the ravine were in desperate plight. They come not fight, except with stones, and the two attackers now were well beyond the reach of stones. Iteters was the only thing left, and they began scently to creep away. Hardly had they started when they were frozen in their tracks by a sholl, uncartoly cry from far down the ravine. It came nearer. They stood asterning. They had heard that sound before

OMAK began to whimper. They heard koka Joe and his follower cry out, then the sound of burned footsteps. And when the group above the rayine approached the edge once more the two possibers had disappeared. The cry too, seemed now to be moving away. They could not tell what it was, but obviously it was the same sound they had heard that first day on the island. They looked once more down the rayine, but nothing was insight. Obviously, kiska Joe had fied. Reaching the cliff edge, they gazed out across the beach.

The schooner still lay at anchor a mile away, but the boat had left the beach. Kelly made it out as it was being hurnedly rowed toward the schooner. They saw it go alongside, and saw four tiny figures climb on deck. Plainly Parker was with them, a prisoner. But why had kisks Joe fled from the cry? And what had made the sound? Oomak was the only one who tried to explain it. He wished now that he had risked hisks Joe's anger, for at any rate kisks Joe was a man, and this thing that shricked about the island well, these white men could say what they pleased, but he knew, and knowing, be was afrain.

It was a downcast group that assembled in the cave that



There was a cry A body fell to the ground. A hand mached through the door and lay with its fingers nutstratched in the freight. The man about the table temped to their feet

evening. They blamed themselves for Parker's capture. What won a happen to a mention of the could not guess. Furthermore, they suspected that kinka Joe night take it into his head to land again sometime, to surprise and capture the rest of them.

They realized they would have to guard against a surprise attack, and so for the next week they labored at erect us across the narrowest part of the ravine, a barricade that would prevent anyone from coming up their path. They made a ladder for their own use, and kept a constant lookout lest hiska Joe should come upon them unobserved. It was while they were working on the barricade that they discovered the packages Kiska Joe and dropped. One was a ham, which they pounced upon with delight. The other was a small bag of dried beans. Both apparently, had been intended as offernation the spirits of the island, but they were welcome additions to Ountak's larder.

Having completed the bacriesde, they made a circuit of the island, and found two other places where routes led up the coff to the high table land. One of these they were abse to break down for it was merely a pile of tumbled rocks that formed an irregular series of steps. But the other rould not be destroyed, and they had to content themselves with cutting small frees and brush, and covering the place, hoping that thereby it would escape discovery.

Furthermore, in the evenings Thornton busied himself with making four wooden guns, which he blackened with charcoal.

'Not much good for offense' be expanned when Williams laughed at him. "But once we get behind our barriende, they may make a showing that will keep Kiska Joe back."

"Couldn't we make gunpowder and real guns" asked kelly, whose admiral on of Thornton had grown to the point where he thought the engineer might be able to construct anything.

IF VOLLL find some sulphur and saltpeter we'll do it." I needed Thornton. But I m alread they even t here. Anyway we don't need firearms. We can line the edges of the raying with boulders, and if anyone tries to come up we can roll them down, and they can't get past our barriende."

It was a week to the day after Parker's capture that they resumed their work on the boat. Within a few days the logs were all split and laid out where the sun would shine on them.

In that time Thornton had planned their program.

For a week they made charcoan until they had a huge pile beside their blast formace. Next they made two litters on which to carry ore, and pressing Oomak into service, they made trip after trip, handing about two hundrest pounds of ore at a time. Their method of weig ring it was simple. Thornton weighed one



however as I mosely pounds, and so, has explained him us a liter they afted [no. and linen tried to approximate bis weng it with a load of ore.

"How prices will we need?" asked Wilmans. "And how can-

31:1 Jeh?

We can't tell caucity " replies Thornton. "But they are is mel. Judging from the amount of nictal we got from the ore we signified before, it should be about sevening percent from In other words, nearly baree handred of each foor boodred postnile of one retroit. Of course, but was we have to do it we ean't get that much out of it. But suppose we get hits persent Then, if we want two thousand pounds of iron and steel we wal need two to sent ore. To be safe, we better losse pions. We may runt a lot of it Let a lake therty litter loads. That sogat to be enough. If it is a 1 we can go for more

COTHEY carried thorty heavy loads of ore and piled at beside. Their formee, and then devoted a day to breaking it up into small pieces. Nor was that all. They found a small hel-

"Fige, cried Thornton when W Biams came in with a hit of the stane. There I didn't think it would be here. It sprobably the deposit from some old dried up but spring

Han granted Kedy Do we have to carry a lot of that

at iff, too?"

You let we do. reputed Thornton. "But not so much of it as we carried ore. That a something to be thankful for."

After two weeks spent in making charcoal, and in carrying organd lungstone, they were ready, once more, to start smelting.

"We dibetter repair the furnace, suggested Thornton. We don't want to stop, once we have it started, onto we've limshed the job."

So, while Widmens complained and Kelly grambled they created out the chantest ke affort, colarged it made larger belows operated by jointed sticks arranged something like pupip handles, and at just filled the furnace with kindling charcoal ore, and imestone

Now for jug ron, said Thornton "We can't east as we go, so we'll have to remelt the metal once we get it. He thrust a burning brand through the cinder notch to ignite the kindling, and leaving Williams and Thoraton toping. the improved bellows, he set about digging a series of complicated ditches in the sand, with little channels

leading to small oblong pits two or three inches deep. "What a all that for?" asked Kelly, pumping until

the flames shot out of the stone furnace.

"To make pig icon," replied Thornton.

"Pretty small pigs, don't von think?" asked Williams. "Done purposely," returned Thornton. "We can t

handle but ones."

Within an hour the molten metal began to collect in the bottom of the furnace, and after another hour Thornton broke the clay stopper and let 1 run forth. He watched it carefully to determine just how rapidly it was collecting on the bearth, and enlarged the hole from which the molten metal ran until he regulated the flow almost to balance the speed at which it was conlecting. It sing crude wooden shovels they laid chopped out with the adse, they kept the little furnace filled with the three essential elements. They took turns pumping the bellows, shoveling, and watching the

Thornton directed the flowing from into set after set of the crude mode, building little dama of sand nerosalos muna channel deazing them out and recontiding them further down. All day they worked and on into the usgat. The morning sun rose again before the last of the streng trickled from the caked smoot and the worn group went to their cave and threw themselves upon their bests.

It was done A month after landing a nest naked on that desolate spot. They has manefactured out of the island a raw materials more than a top of iron?

Early the next morning they were ready once more to renew their labors, yet alriost at once they were con-

fronted by a new and pouching mystery,

Domak had set about getting breakfast, and first looked for the axe, to split some wood. It was gone. At first they did not take the loss scrimisty, and then Donak sudderly discovered that the page of hair they had not eaten had desappeared as well. It was only when they began a systematic scarce that they found

the one's an teat had been ach ben in. On a smooth rock a dozen feet from the door of the case was nicer to reasong done with chargoal. It had not been there the night before, for on that rock hody had atarnesed the adve, and Wilhams but rebbed the aveldane. It was a west and very crude drawing of a bord wit in hoge heak-with great round even, will i powerful wrige drawn in (cli fight. It was not table non-e of the strange birds that surmount loteri poles.

Courses a ever grew wide when he saw it, and he blanched

beneath las swartbaness.

The devil come to kill us!" he cried. "It is the sign. It mean we the see have enemy sleve marche. It is the sign?

That sumeone was on the is and beside the upgely as they felt certain now. Still, though they made mother entre circuit of the island near the shore here, they were i an sle to find a sign of any other inhabitant. So they returned to their tasks. determined to goard themserves and their possessions even more carefully than before.

They decided upon a division of labor. Williams and Kelly, boilt a little dam across the stream and erected a water wheel, while Thornton constructed a lathe. Commit, in the membrae, surprised two more scals on the beach, and ki led them. The skin of the first one, removed whole, was nearly half full of scal oil. The Abrut wanted one of them for an offering to the devils of the island, but the others refused. Instead, the two skins were tanned after Ooniak had scraped them clean wil i his obsidian kniver.

THE lathe, driven from the heavy water wheel by a belt of A walsk is was a rough y built contrivance, made with wooden bearings, wooden shafts, wooden pulleys, and a wooden frame-There was little metal in it except rails, rivets, chuck and spindle. But it worked, and on it Thornton made an improved set of wooden shafts and nearings to replace the ones bewin by hand. Then he forged a shaft of meta, on an anvil they had east, and after pincing the forging in the asthe as he would have placed a piece of wood to be turned, he managed after two days, to get it turned down with the tools he had made and by tisting saind and stone as alreasives. I understand on page and,

A Wonderland of Science

Amazing machines seen at Popular Science Institute of Standards that guard you in buying tools and radio equipment

By

ALDEN P. ARMAGNAC

NO thousand men pulling on a hammer handle! Corrugated with massive gears, a huge wheel turns slowly, almost imperceptibly, but with mexorable force! A mechanical hand two thousand times stronger than none prolong on the handle of a harmner the claws of which clutch the head of a heavy wire mail. The mail deelf at churched to the bed of the machine. Yet the mechanical hand pulls the nail with childlike ease! That night met my eyes as I entered the laboratories of the Popular Science Institute of Standards. Two engineers were bending over the machine that trapped my attention. They were measuring a strange thoug—the grip of a hammer's claws!

You or I might buy a hammer like that. Would we gensp a nul with it, only to see the null slip through the claw? Wait a moment -over the cound dial. a needle thekers. The null writhes free from

The peachine's base, and the gears stop. The lum mer's claws, bolding the pulwith a viselike grip, passed the test

Next, will our barnmer head stay where it belongs? is its face tough and no-Will the Lamille break? Like a carpenter's arm but made of sheel, mother maca he poords the hammer on an anvil ten thousand times, trying to dent its face or loosen its Then a pharger successes a tiny bararded steer built into the leadwith terrific force to test

its hardness. Last, the handle is deliber-

ately broken.

Did you ever break a hammer handle, tigging on a balky nail? Back goes the nammer to the first machine. This mechanical hand polls on the hammer handle while the tip of the claw clutches a linsky bolt-that can't let go! Some-



Talking ever the results of a load openior test. Prof. Colling P Birm, director of Popular Science Institute of Standards (left), and Alexander Sciences, endic engineer

thing will have to break. The geam revolve. The needle swings downward The handle creaks under the mounting strain. Snap-the hammer lies useless, sta handle broken in two. How much steam did it take?

blure than two hundred pounds on the ten-inch hammer bandle registered on

the dud as the learnmer. broke. When a 1 do. point man bangs on a banning with alt has

How hard up the piler javal. C. T. Schwarze of the lastitute eto V is conducting this test. All tools are tested by muchines numbering human handling, and every tool passed is guaranteed

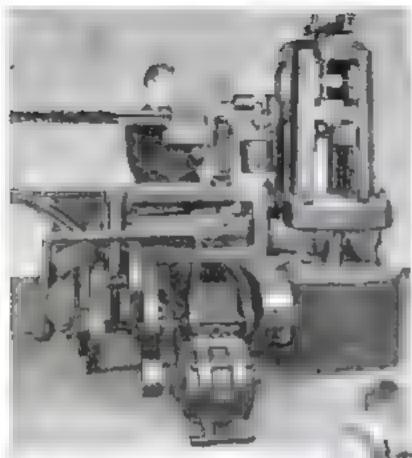
weight, he gives it all the punishment a good tool abould be able to stand. This hammer did better. If you bought one like it, you need have no fear that it might fail you, for these tests, completed in a few minutes, have given it as severe freatment as it would get in years of everyday use.

At no other laboratory in the world are there such tests. They have been invented to simulate as closely as possible the way you or I might handle a handner. The machines are as nearly human in their movements as actentific ingenuity can make them.

In these amazing laboratories are muchines to test almost every kind of tool and every type of radio apparatus. You each of these tests is just as thorough as that for a hammer. These tests were established to protect you and me in our purchases of apparatus of a technical or semitechnical unture; to tell us whether the radio set, the loudspeaker, or the tool we hav is a good one; to substitute, for guesses, scientific tests of hairbroadth

In the radio laboratory for example, novel tests supplement examination of n rumo sets parts. Before a set has emitted a single se rid, institute experts can tell you just how well the outfit will reproduce a speech, a atring quartet or a bratsu bacad.

Visid ite silence filles the room. The impiense loudspeaker on the wall was Mexander Schatike, ratio engoneer was testing a receiving set. Only quivering imbeators on the electric dials of his matriament betrayed the source of the figures he was jotting down. Yet with these figures he traced a curve on a short showing at a glance the tone quality of that particular set. He knew definitely and accurately whether it would give you a thronty gargle and an unsafelige c distortion of the bundan voice, or a faithful reproduction of the music and voices that its auteura brought to it.



A giant testing machine at the limitute crushes the pass of a best clapper as easily as if they were cardboard a acuse measures the force

Signals to test radio receivers come from a minature broadcaster right in the laboratory. Outside signals might vary in strength and spod the tests. But here is a training station under instant control, that produces a radio wave to correspond to any desired component of an orchestra or human voice. Popular Science Institute tests for radio equipment, Mr. Schauke told nie, are the most complete in the world

Every day the engines of these laboratorics answer scientifically the layman's questions. "How well doesn't work? How long before it wears out?" Every day brings new problems, problems for which they must invent new tests.

There was the manufacturer, for instance, who was trying a new steel for the shank of his spiral rate act screw driver. He came to the Institute a tool laboratory and asked how long the groove in his new tool would last. The wear on the groove, twisting the acrew driver in response to a straight push on the handle, depends on the pressure of thrust. To test the hardness of the steel used in the tool was easy. But the manufacturer expected the Institute to tell him just how long the tool would last. So a new test, a test for spiral ratchet screw drivers, was invented.

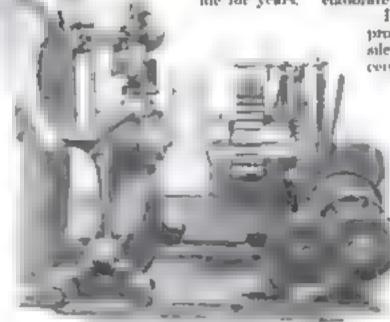
THE Institute engineers, therefore, A drove into an oak plank an ordinary wood serew—twisted as tight as a man with a hand screw driver could set it. Then they mounted the block, screw and all, on a rotating spindle. They put on a brake drum, too, with an adjustable brake, and set their brake at a tension that was just a shade more than that required to turn the screw. Then they mounted the spiral rateliet screw driver in a reciprocatme machine that thrust it back and forth ngainst the screw on the braked wood block. The screw sank into the wood natil ets tension equaled that of the brake -then the screw balked and the block spin. From then on, the tension on the screw driver blade was a lifelike imitation of a

screw being driven home.

The device was run continuously for several days. At the end of that time, the screw driver had delivered enough strokes to drive forty thousand wood screws! It had had the equivalent of years of heavy everyday usage. And the manufacturer was given the information which he sought.

A versatile device, that reciprocating maclime—it tests pruning maclime—it tests pruning shears as well. Their weak point is the flat coil apring that opens the blades. A few thousand times open and short tells the story. If the spring is still undamaged, a similar pair of

alveara with last you or me for years,



While meetive gears resolve a mechanical hand pulls the harmore clutching the said and so the grip of the saids is determined.

Serew drivers and monkey wenches turn to pieces! A strange mix lune twists a screw driver to find when its handle will spinter, its point clop, or its shank twist apart. Another clamps a wrench on a square steel bur and then foreibly twists it off, to see what will imppen to the paws.

Thumping machines, pounding machines that lift a heavy weight a standard distance to let it drop like a pile driver on the tool in their jaws—stand beside giant testing devices. A monster nuteracker smashes bolt clippers and pliers to bits. Other devices run by electric motors twist and pull apart husky bars of the same cold rolled steel that goes into tools. The largest of them has a crushing strength of two hundred thousand pounds!

WHILE these mammoth testing machines are devouring tools in their jaws, more debeats tests go on in the radio laboratory. When B-battery eliminators first appeared on the market, it was at the last tate of Standards tout their hum was actually measured and compared Vacuum tubes and batteries receive the lastitute's scal of approval only after claborate tests.

> Londspeakers present peculiar problems all their own. Here the silent testing must cease. A receiving set yields electric impulses

> > that the eye can read on instroments, but a landspeaker delivers sound alone. How could it be incasorest?

The human car doesn't hear all sounds equally well Just as the eye sees some colors brighter than others, so the ear hears sounds of a certain pitch better than others. A loud-speaker perfect in theory, that shot out all tones equally loud, would not sound uniform to the ear at all.

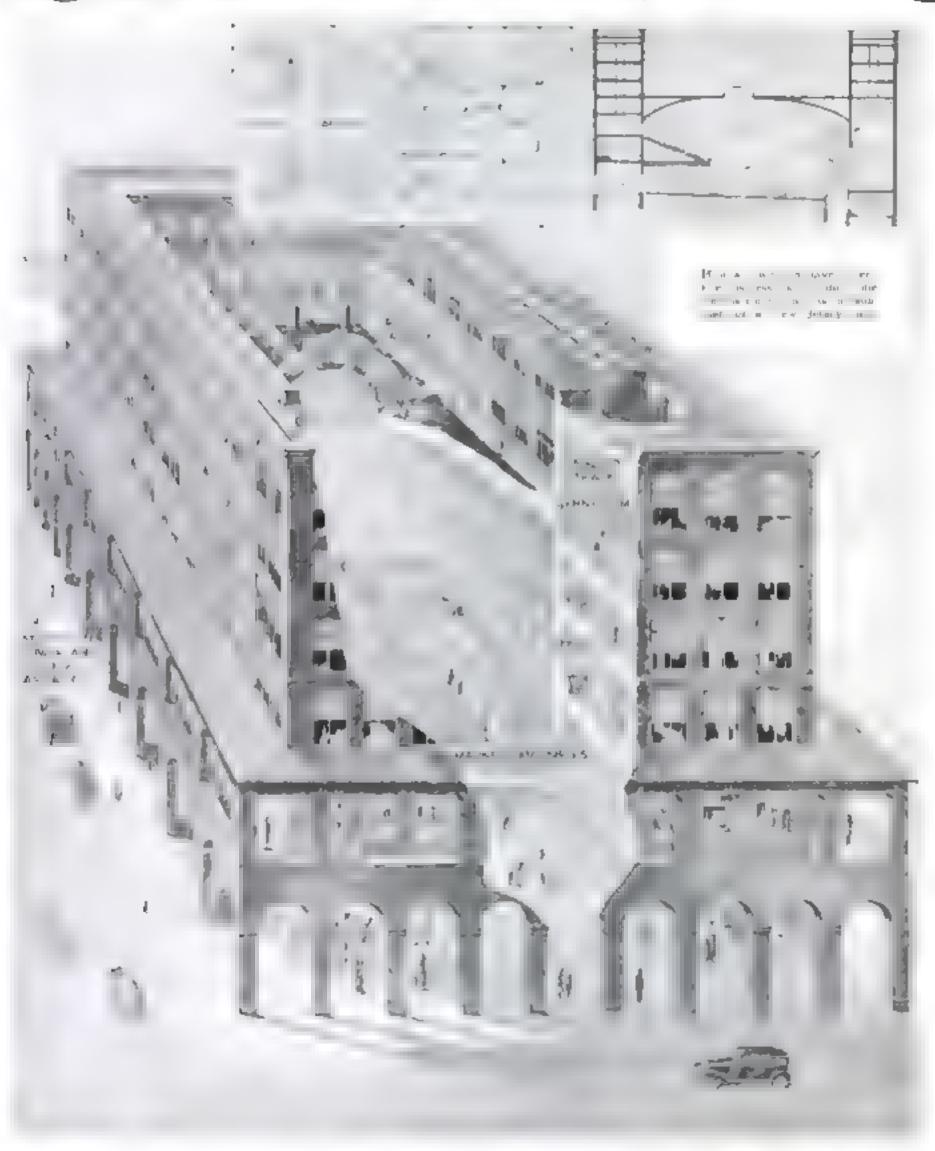
bo the workers at the lu-

Telephone engineers, they knew, adestepped the difficulty with what they called "trans- (Continued on page 140)



Stadio acts are tested for every moneivable thing -nomething no other organization does. This elaborate array of expansion tests the life of battaries under the same usage you might give them.

Ingenious New Community Building



COMBINING under one roof a town's cubic scopping, business and theater district, a novel 'community bonding is promised by Joseph Fack of New Bronswitz, N. J. Under the plan a town circle transment its 'Main Street to the inside of this structure and build an attractive resisential section around it

Drawn by our artist from Mr. Falk's designs, the picture shows the buge rentral theater austromain, surrounded by two levels of stores. The auditorium is transformed into a dance half by leveling the stoping floor with hydraulic lifts and removing the chairs. Above are business offices, lodge rooms, and a roof garden.

Such a bir ling. Mr Falk estimates, having a 120 foot front world not cost more than \$300,000 to burn a profit able investment in town beautification, repaid as well by the economy of central beating and maintenance. Store deliveries would be made through a single service department,

Touring the Country in a Tree Trunk



World's Largest Lock Gate

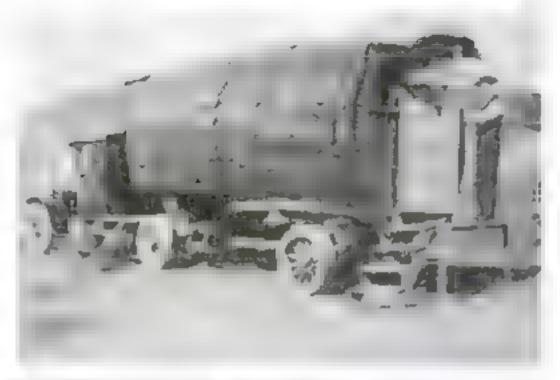
MORE like a skyseraper in appearance than a gate, this mighty structure is one of the leaves of the lock gate that soon will close the river entrance to Liverpool's new dry dock. When completed, the dock of the great English port will be one of the finest in the word and this sock gate the largest in existence.

Russia's Superpower Project

RUSSIA will have the largest bydraresently announced are realized. Built
on the banks of the Daieper River the
plant will have a capacity of 630,000
barsepower, surpassed in this country
coly by Nagara. The Soviet government
has retained Cot. High L. Cooper, who
designed the Wilson dam at Muscle
Shoals, as chief consulting engineer for
the project. Other projects, of smaller
size will be additional links in Russia's
superpower chain.

Beating the Housing Shortage

APLOT of ground in France—at least 10 Paris—costs more than an oblipentoon boat and the same area of water—so a Paris workman built thus best two-room bangalow, pictured at the right, for his small family on an old boat abundaned along the Seine River. Just now he is anchored opposite the Louvre museum of art treasures, but when he wants a change of scenery from his basknoon window, he'll east off and float away to a different location.



WITHIN the grant hold lowed out track of a Douglas for, mounted on a motor track Mr and Mrs. E. A. Wade and their son of Canfornia, are training the country. Their movel temporary home is a modern was room, apartment that contains all the comforts of home—built-in breakfast nock, cupboard, wardrobe,

even electric light and an oil stove for cooking. Two lieds that fold against the wall provide surple sleeping accommodations. Mr. Wade under a killing took to be tore on limber conservations.

New Element Isolated

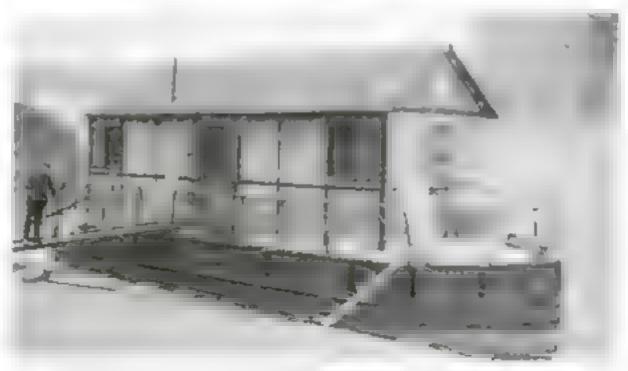
AFTER a deficult refining process, A Dr. Walter and Ida Norldack of Berlio Germany, discoverers of the new coemical element risen in have socceeded in obtaining and testing two milligrams — seven—one-laundered thou sandths of an ounce—of the precious substance. Their first report of the discovery of the new metal was based upon

times detected with the camera and spectroscope in the X-ray spectroscope in the X-ray spectrum of platinum ores. A black powder of logh melting point of a compare system of pure exception it ignites spontaneously, leaving as ush a white uxide. It combines readily with other chemicals.

Science Weighs a Mountain

SFEKING to discover the mysterious forces that hard modern lava countricisation of Manual Loss to the Hawtonian Islams, accordance to weight the restire topological.

It is unpossible, of course, to devise scales to weigh a mountain peak which reaches down some three in less trainer the sea. Instead, the actentiata wild the awanging pendulum ansuremed from corelolly leveled supports to determine the intensity of the earth's gravity from place to place on the mountain. From variations in this intensity, they expect to discover whether the inner core of the volcano is lighter, so that it rises in seeking an escape, or whether other forces are responsible for the eruptions.



Rema and landlords no longer worry the thrifty Frenchman who built this bungalow host

Railway Train Built from a Flivver



THIS odd locomotive starts with a crank. Once a fliver but now, with flunged wheels, a one-car train, it runs on the regular tracks of the Tabor and Northern Railroad between Malvern and Tabor, Iowa. Only rarely, when traffic is assuably heavy, is it replaced by a steam trun. Even the aignals on this line are out of the ordinary—an arrow shows which way the awitch is turned.

How the Moon offfects Quakes

THE moon exerts a direct influence on carthquakes, points out Prof. If F Reid of Johns Hopkins University, as a result of recent investigations. Just as it pulls on the sea to focus the tides, the moon strong on the earth. Should a "fault" or shipping of rock he shout to occur for any reason, in a given direction the moon in one position would hasten it, in another, it would delay it

Device Takes Telephone Messages

SOON it may no longer be necessary to stay at home in order to receive telephone messages. A new Swedish suven tion answers the phone, takes the message, and repeats it to you when you return! The apparatus has been under test for several months and is now re-

ported to have passed all tests.

When a call comes in to a telephone equipped with the device, the apparatus sounds two hells to indicate that no one is home, and a message must be left. Then it records the caller's voice, as he gives the message, on an unbreakable and mexpensive phonograph record, composed of a highly sensitive material coated on cardboard. Play

the record when you return, and you know who called and what he wished to say

Aluminum Made from Clay

COMMON clay now is to yield alimit noon, in Germany, by a new process made commercially practically by the phenomenal increase in the use of aliminum throughout the world. In the process the alimination compounds are dissolved from the clay by means of power full neids on process made economically reminerative since the discovery that silica a by-product of the new process is valuable in many industries as a catalyst in the form obtained when aliminum in isolated. Although this scheme has long been possible in the laboratory, it has never before attained a commercial scale.



The airplane carrier Langley, loaded with planes, speeding to the first a rectal battle names were



Leviathan Gets a New Dress

THERE is more to a great ocean liner than generally meets the eye—witness this unusual photo of the Levisthon, taken recently at South Boston. Mass. But in dry dock for a fresh coat of paint, the ocean mounter lies with the whole of oto encemous holk exposed. Note the relative size of the pygmes at work with paint and brush below the water lies.

Wool Made from Pine Needles

CHEMICALLY treated pine needles are being made to yield a useful substitute for wool in Germany. In the process the result is chemically removed from the needles, leaving a "pine wool" of fine strong fibers resembling hemp. This wool is woven into heavy fabrics.

The resin by-product is a valuable fuel. Shaped into briquettes, it has a high heat value and has been used in the manifacture of artificial diaminating gas.

An Air Fleet Goes to War

Like dragon thes on a floating piece of draftwood, twenty-five planes perched on the upper deck of the accent carrier Langley, pictured at the left, as it crused along the California coast to take part in the fleet's recent buttle graneuvers. The photo gives a striking picture of how a modern amplane corner would look, sailing forth equipped for war. Note the corral-like inclosure on the landing deck above, and the unusual position of the ship a smokestacks, made necessary by the floating landing field Additional planes are carried on the lower deck and in the russ.

A 10,000-Watt Sun for Airplane Landings



CENERATING such terrific heat, when lighted, that a special glass had to be developed, buge 10 000 wall acondescent lamps are being made by the Westinglouse Company to relatively melesical in a device sunday to a light noise sens, is said to be sufficient to this mate an airport runway \$ 100 feet ling. The new lights are intended to a updement, the light refersity searchights now used on the fields.

In the plustration, an engineer of the receipt voice is a daming and features to trovercement officials.

Now-Ball-Bearing Trains

A STANDARD som Pullman car so the thousand that two men can pull at along the gives gods, is the marvel rande provide by new roder bearings for car where a replacing the present fraction bearings. After a try-out on the Chicago, Milwa more and St. Paul Rai way the bearings are being placed on more than a righten cars. The first time that complete acts of passenger trains have been equipped with realer bearings.

In one test a conchequipped with the regulation friction bearings commenced to move when the locomotive exerted, 9000 pounds of force. Another concher tupped with the new roder bearings, look only 500 pounds force to start it.

A 20-Inch Cigarette Holder

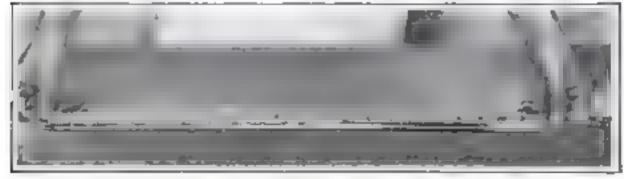
LONG-RANGE smoking is possible with the navelty eigerette holder below. Twenty inches long when extended, it telescopes to four inches to sap into a pocket. There is no danger of getting fumes in the eyes, either



You'll Soon Be Phoning This Way!

TWENTY million telephone receivers and transmitters now in use in the I inted States are gradually to be replaced by a new type of telephone, putered above, combining receiver and monthpiece in one. Patterned after the European-type phone, the instrument is the product of experiments by the Bell Telephone Company and is said to be no improvement on the Company and its said to be no

It is easy to use—sumply lift the phone off its rack, as shown above, and hold it in position at mouth and ear. Replacing it on the rack shuts it off. Its conventence is obvious, and, being only half as high as the present deak telephone, it cannot be knocked over so easily



Immring a contamoke -catended, this helder measures twenty inches, it collepses to four



Corner Subways for Pedestrians

PICTURED above in the entrance to one of thirty-nine transes that the city of Los Angeles, Califa, has built at its most dangerous street crossings, to make it possible for persons on foot to cross the street in malety. Children on their way to school ac porticular, are protected from the growing streams of motor vehicles that make the crossings perdeus, and where these tainels are built the stop crossings? I askedy provided for school children are in manted. The turnels are waded, floored and reofed with reinforced concrete, finished with cement and are about four feet in word. Their street openings are partly anclosed by cement curinings, to keep out water-

A though pedestrians are not obliged to use the concrete safety (namels, reast of them do, and it is said that accidents have become almost unknown wherever they have been installed

Airplane Engine Fits in Pocket



BABY brother of the grant motors that drive great planes, this remarkable motor—and it actually runs—would fit in a capacious overcoat pocket. A two-cycle engine, it develops a quarter to half a borsepower to drive a small-scale propeller that air-roots it. Bore and stroke are only one and one half inches.

Handy New Aids for Autoists



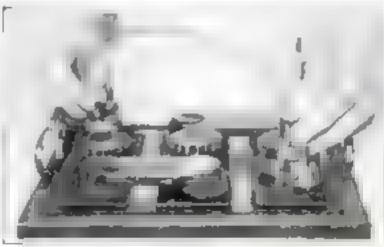
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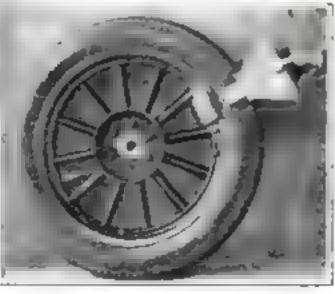
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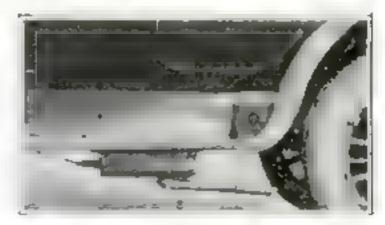


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A disast nerves of the train of dearer 1 V A R no (rs m A) and the the condetends have the fermion at a care as more more than the me wheel gives the me and a made to the mean agreed to the rear wheel

Thinner Buildings, Wider Streets, for Future City



TTTRE tarban bereforge must be I to ler and thinner and occupy, relatreesy, less space as compared with architect, Raymond Hood, He would solve traffic problems of great cities by allowing six times an much space on the ground to streets us to buildings. Recently exhabited in New York, a model be has made to illustrate his plan shows how a city of low roofs might evolve, by careful planning and easy stages, into a city. of isolated towers. In the disstration, Mr. Hood (left) is explaining the details. of his movel idea to a fellow arch test

KNOW YOUR CAR

SAFETY of sterving an auto-at-night depends large von voor ocadlights, when you get away from the brahantly thom sated city streets. If your headl gots should go ant at a critical insoment, perhaps going around a sharp birn, almost anything in the way of a sera is secolent naght happen.

Of course, stace you have two heanlights, the chances are small that both bolls will born out at exactly the same instant. The classes are equally good that both lights will never go out at the same time through a breakage in the individual wires to the headlights. The most vital point, therefore, is that part of the waring from the battery through the switch to the point where the headlight wires ranch mit. Observe these precautions, then, to insure safe night. daying:

- Inspect the battery terminal. connections at regular intervals.
- 2. Make sure that the wire connections to the lighting switch are tightly clamped.
- 3. Look over the wires occucionally to see that they are not becoming chafed or worn through at any point

Sunspots Cause of Wars?

PERHAPS astrologers of old were not completely wrong in their belief that the course of human life depended on the stars. Prof. A. L. Tehtjevsky of the Moscow Astronomical Observatory recently predicted "great human activity of the highest importance which may change the political chart of the world, as a recult of the expected three-year period of intense sun spot activity that commenced this year

Intense win spots tend to excite bunian pervous systems, says the professor, and arouse masses of people to extraordinary activity. Most great were and political crises, according to him, have occurred during periods of maximum ann spots.

delicacy of touch and accurate judgment

of distance. On the intellectual tests, his

marks bettered those of college students.

The tests were conducted by Dr. A. M.

Johanson, psychological expert.

Canadian Police Signal System

of them designed by lamself

WHEN Montreal a chief of police wither to speak to a policeman or detective anywhere as the cosy, all be has to do is give a word to lustdesk operator-A moment later flashing lights on Top of all the poles of the policemics a heat a mimon has to a phone, or give I in orders through a unsque numbered code.

Wuconsin's Champ Whittler

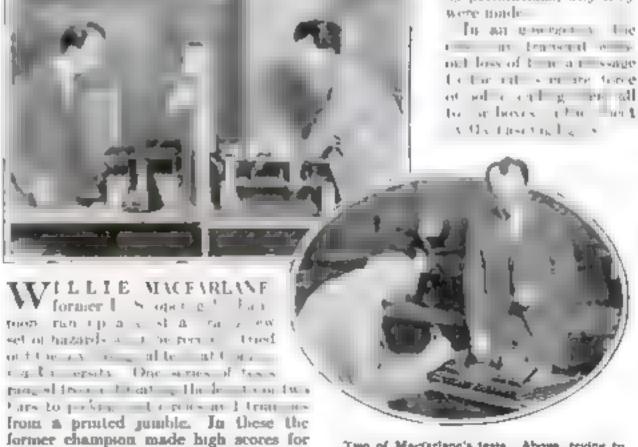
I T of a single piece of wood, Fred Hence, of Platter He. Wis., carred It of the introduce pieces spread on the tarde sees a Course pulley filodes and make gotto are among them; all

This is only one of the remarkable features of a police signal system the city. has just imitaded. The moment an officer places his key in a potice box, a bell starts ringing at headquarters. He need not even open the box in order to call the patrol. The operator can strumon

loor back after a routing call by a baster andible 200 feet away, All calls are at 5c millionly record. I or apaper tape that anows, ry perforations, why they

Letter rate is made from g to achieves the liert

A Noted Golfer "Tests Himself"



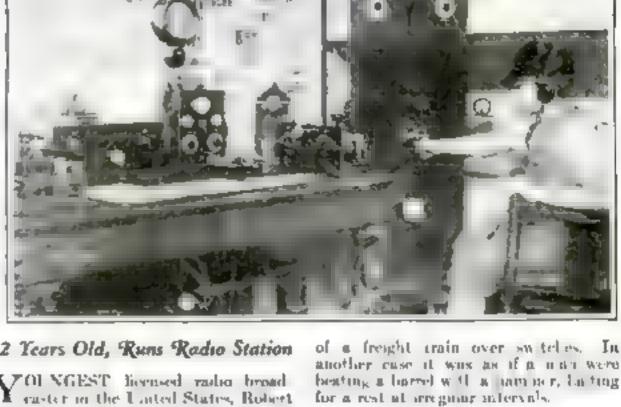
Two of Macfarlanc's tests. Above, trying to plunge a pointer in rapid succession through three holes without touching the sides. Each miss makes an electric contact. Dr. Johanson holds the stop watch. Upper illustration, measuring langue of lingers from pulsage on a weighted cord in time with a metronome



Pygmy Hunter Back with Trophies

BACK from the wilds of Dutch New Games, Prof. Matthew W. Sterling of Berkeney, Cant, leader of the Smithsoman Pygmy expedition, recently refurned to report the discovery of a new tuce of pagames. Strat ge ort son obs and a pleasents of the tribe, a few of whata are shown above, were brought back-

THE DESERVED OF THE RESPONSED LESS year an interorded heaven's visitor was sig ited recently by Prof. Carl Leo Steams. of Wesleying Laversdy, torongly the twenty each refract is at the Yan Vleck Observators Middletown, Conn. Of on y the reath imigratude, the counct was n vis ble wit nort a small telescope a and,



12 Years Old, Runs Radio Station

COLVGEST licensed radio broad Marx, of New York City, convenies with Europe every evening from his station WAZE Only twelve years old, he rends rode signals at ama ing speed. Her wave length as forty meters, and has call letter is tambar all over the world. The illus-Indian shows lengal the many switch of ha one kdowatt transmitter. On the wall are call letters of stations he talks with.

Heartheat Like Cannon's Boom

TWO loudred medical students at the Traversity of Perusylvania laid the starthing experience the other day of bearing patients heartheats, at a dostance of ten feet, come to them like the booming of distant common. The sound was made and-ble by a wonderful new electric stellioscope capable of magnianother case it was as if a non-were beating a barrel with a maniner, butting

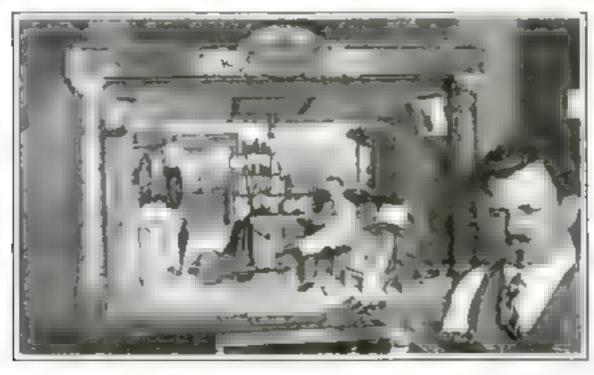
New Steel Defies Nicks

NEW steel, and to be eight times A harder than any of American man to facture, has been developed by the bright Krupp works of Essen, Gernany Dem oustrated recently in this country, it wore smooth the edges of a sest lice and in insorcessful attempts to nick it. A cutting tool raide of the new alloy severed clean vitte neck of a glass rottle

How Much Do You Know of the World You Live In?

TEST yourself with the twelve I guestions below, selected from hundreds sent in by our readers For the correct maswers, turn to page 144.

- I What famous harbor occuples the crater of an extinct volcano?
- 2. What famous trees live only on one small peninsula?
- 3. Who were the moundbuilders?
- 4. Why do houses in Bermuda have whitewasked reofe?
- 5. Why are Panama hata made only in one part of the world?
- 6. Where are Roman skincovered bouts still in armes.
- 7. What are the floating islands of the Nile?
- How were the hanging gardens of Babylon supported?
- 9. Where are monkey ashes used for medicine?
- 19. Where does most tip come from?
- 11. Who began irrigation?
- 12. What is the difference between the White Mile and the Blue Nile?



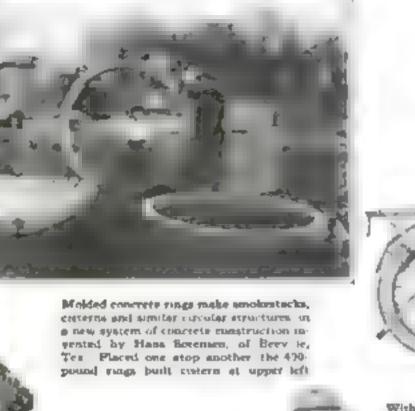
Violin Maker's Jackknife Art

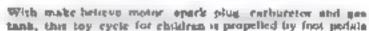
WITH no other tool than a kmfe, Moise Potvin, expert violin maker, earved out of wood this remarkable deta-led picture of a acene in his workshop. Like the familiar Swiss wood pictures, carved and framed in much the same fashron, the charm of the swork has largely in its faithful reproduction of such homely detail as an umbrella, cout and but, and pictures on the wall. A near-by bunding can be seen through the window.

fying heart noises 500,000-000-000-times! If the energy of a pocket flashlight could be magnified to the same extent, it would develop more horsepower than all the electric generating plants in the

The instrument, a product of the Bell Tele one Laboratories, combines a stelloscope with an aprolifier and powerful loodspeakers, revealing in startling fashion irregularities in heart action. Thus, when applied to the heart of one patient, the noise resembled the rumbling







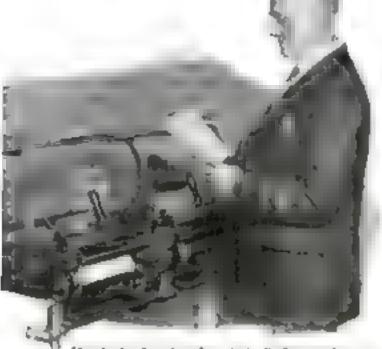
Waterproof soits, distimely the prappear arre are the intest adaptation of the new rubberseed fabrics. Intended for consister what to anterpare midden show are that would raid show where said to be comfered and to be comfered to went and in pervious to went and in



Taking such waste materials as ashes, shawings and peat. Johann Ludwig, of Varana, compresses them outs bracks reported to be of high heating value as furl

In this newest indoor golf game, an eighteen hole "links" is told out on a table accesshal like a billiard table. Billiard core replace golf stoks, and the "hall in a heavy disk the use of a silver dollar. While he makes an effort to sank the disk into the cup shaped "holes," the indoor golfer encounters many a "hazard "obstacles that has approach to the holes.

in New Inventions



Musdreds of copies of a criminal's finger prints are turned out rapid's by this depointing machine, invented by Larut William Burns of Saltimore. The new device works like a summonroph machine.



A phonograph that plays for a full hour welbout attention? This latest development in talking machines at made possible by a device that automatically feeds twelve records to the turntable from a magazine, with half-mixture stops between



Cignrettes and matches go together in this ingenious new combination case. In the bottom of the leatherette pouch is a holder for safety matches. The top holds a package of cignrettes



Intented to aid a lone tight twitch-man on a Boston tool way this combins tion lanters apports the lanters, can be waved to tight a lone appired into the ground of deured.



Monkey weenches in the hunds of three men put this "permanent but pertable" bouse together in eight hours. Walls of invulating fiber are accessed to a frame of stool rods, the extense is attached and interior control with a special composition.

Krupp Works Turn to Peace

Vist workshops that our read guns and shells to destroy hung a life have now turned to peacetime products, at the gunt kropp works, in these German. The diastration at a right shows a cooper of this famous war factory as it is todal to the agricult ratio percents had up awaiting shipment. These, with motor tracks, now are the main product of the plant offer.



Color Piano Has 6,000 Lamps

HARMONIES of color to accom-

are created by a remarkable "consequence" perfected by Leo Geasland, of Los Yasgeles. Card. With one hand working the ten keys of his instrument's keyboard, be creates flashing changes of purple, red and oracle from 6,800 conceased electric halbs. His other hand thrown awatches that control the banks of hights.

Certain color combinations or 'chards' are said to have a particularly emalional appeal, heightened by music. Fining compositions in color for the light-flashing mass in ght be written in modified musical notation, Gensland, however, plays his matrament by ear, or rather by eye

New Grant Dirigibles

THE Zeppehn factory in Germany has started construction of the all minimum frame of a huge airship designed for weekly trans-Atlantic passenger service between Spain and South America. This giant liner will carry 100 passengers, crew, luggage and muls. Eight large compartments will be fitted with every modern luxury. It will be completed in September,

Meanwhile, Uncle Sam's project for two super analogs, each of 0.000,000 cubic feet capacity has been clouded by worry as to how they can be inflated. America faces a shortage of noninflatamable belium gas. There never was enough to float the Shenandonh and



Siebe niche Krispiel ist die area torribie a la wager was het in



The color plants at his metrument and Geft) the electric equipment, including 6,000 lamps, with which he produces his effects

Los Angeles at the same time and each of the new dirigibles will require three times as much belium as the Los Angeles now uses.

Also, the chief source of belium supply in natural gas at Petrolia, Texas, is failing. To remedy the situation, a new supply will probably be developed from belium-bearing gas at Nacuna, Texas,

Quartz Motor Run by Radio

RIN by radio, a novel electric motor of the criterian radio engineer, has as its rotating part a small plate out from a quartz crystal. Placed in a radio circuit, the crystal vibrates and sets up air currents that cause it to spin. Too weak to be of practical value, the motor is bowever, being studied with interest by scientists. Quartz vibrations in a radio circuit, they point out, have another interesting application in keeping broadcasting stations exactly on a proper wave length.

Fight Shipworms with Paraffin

WOODEN wharves, ships and houses are now being protected against shipworms by a special paraffin treatment developed by Dr. Paul Bartsch, marine biologist of the U. S. National Museum. The process consists of impregnating the

wood with paraffin and two kinds of possons, one to destroy all attacking anomal life, the other, parasitic plants. Blocks of wood treated with the new compound have so far been kept under water for two years without being attacked by a possons.

Let pur l'in trentmer its non hemp tested for its effanct against land arches of auto and hacteria

Navy Mapping Southern Seas

At RIVI corners and sound depth to des are being used at a new sursection of Control to a section of Control to a section of Control
to Historian acts of the oracle of and many arate courses a tree or as be an esome dating back to the authenth century -wal be provided with up-to-date, resulted data as a result of that expedition,

There ships and two amphibian planes are making the survey. On slopboard an observer operates the "some depth finder" that projects a noted wave to the occur bottom, while through his enc-phones the returning sound tells him how deep it had to go before it was echoed. Airplanes, meanwhite, photograph the constitute from above.

Bees Stupid, Scientist Finds

BEES haven't any common sense at all, says a French scientist, J G Millet. Instead of deserving credit for their industry and wisdom, he says, they don't even know a good honey producing flower from a bad one. Experiments have convinced him that a bee in at tracted to a flower solely by its odor—it will fly as quickly to a perfumed artificial flower as to a real one. Looking for sugar, it is satisfied that a sweet secut means a meal, and stupidly ignores inforless flowers with stores of honey

Pink states of mercurochrome, the new household anticeptic, can be removed from silk as follows. First apply benealdehyde then twenty five percent hydrochloric acid, finally sponge with alcohol, then with water. Mercurochrome spots should be removed before a garment is dry cleaned, as substances used in the cleaning will leave them indelible stains.



Part of March make grant new volumeters plant on his Superhage of the

Carried 50 Miles by Tornado

DR KED up and excised away by a torrado recently a sheet of heavy from roofing was found fifty unless away from the scene of the viscour. As a reason the U.S. Wenther Burna. The the motore to pieces a schoolbouse at Ladahu Mil., and was later traced on the ground for only fifteen mass. It is believed a whiching vortex in the upper air sustained the pieces of goat roof on its less journey.

Hormone Makes Hearts Beat

A Ladwig Haberhardt of Le Laversty of Ladwig Haberhardt of Le Laversty of Laborate Ladwig a power of chemical compound secreted within the living heart and spurring it to action. The rempound is to be classed with the secretions of the ductless glands, such as the thyroid

Dr. Haberlandt docovered that extencts from the beart of a frog would act on the stilled heart removed from mother frog causing it to contract again. Experiments with the hearts of dogs had like effects. The Austran scientist believes that the new hormone may prove valuable in medicine as a standard to weak hearts.

Twins' Finger Prints Differ

FINGER PRINT dentification has again seen violested When Prof Woham Crowther of University College, England, recently asserted that treorge and Edward Elis, two brothers, had finger prints exactly a ike, police authorities the world over alarmed appealed for information. Scotland Yard England's famous detective headquarters, made an investigation and found the twins' finger prints dissimilar. One had "three radial loops and seven ulnur loops," the other "one radial loop and muc plant loops."

Comet to Whiz Near on June 26

FOR the first time in a number of years a comet will be visible in the night sky a few weeks from now. The Pous-Winnecke comet, which visits as every ax

Vertical transfer in the second to grand out into be a single of r a v waters, t t respectate se gara it a on a fig. tabe althorad and a market February of the state and todest IIfor a larger to the grade f cartain a risk Fp 4.91 53 car tat so is t tills the state 1 11 2 2 2 2 3 3

comet was or at
its nearest—
four pullion pules
away, twenty

three times nearer than the sun. We may see it then welbout a telescope, in Dic southeastern sky about midnight.

Baby Now Worth \$9,333

THE fact that we live longer than did four grandfathers is beinging as folbons of dollars in each save a great msurance company whose experts estimate that the total increase in carning power of American men and women in the present generation, or since 1901, is \$3,500.5 000,000. This gain, they declare, has been due largely to the extension of life.

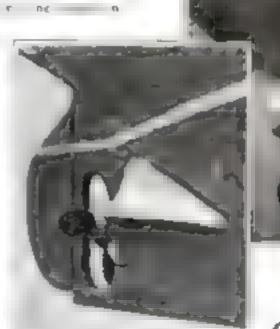
In 1901, a baby how at both was considered to have a potential value of 85 a.3. By 1924 this value increased to 49 325. This pain also, they conclude, is due to the expectation of longer life, with a consequent longer period of earning capacity.

How Cool Should a Theater Be?

Society of Heating and Ventilating Engineers, women students from the University of Pittsburgh are being weighed and observed in novel tests to find out how a cooling system for a theater should be designed. The girls are weighed on special halances that record a change in weight of one-thousandth of a pound. From these weight changes, temperature standards will be established.

Maryland's Giant Power Plant

GREATER than Muscle Shoals and second only to Ningara's hage generators, this monster power project on the Susquelanna Rover in Maryland will soon be completed. Sever in the stratum generators will dispatch electricity over a 220 000-colf francoission line to Philadelphia savty inner away. Nearly a note long, the huge Conowingo Dans a ross the river is seen at its nor hierarchical than the present power of Missen Sposion and come at to hall ten of New York a "White Ways."



More power to a steamer a propeller two castallations of the new fore which deflect water to the propeller

Propeller Fins
Speed Up Ships

Cliftiot S fem attac and to the had of a vessel near its serew propeder are used in a new Engish invention to increase the hoat's speed

and lower fiel construption. With the ordinary form of slop, water flows in an upward direction to the propeller. The new fin device relieves the propeller of the work of making that flow of water move largeontally.

Tests of the device are said to have shown fuel economy greater speed, easier steering and absence of a stern wave.

Edison Raising Rubber

THOMAS A EDISON world farmant inventor sees the great cotors plantations of the South transformest a to producers of rubber. With Henry Ford, he has established an experimental rubber plantation at Fort Myers, Flan, where he is conduction remarkable tests with rubber that grown from a "vine" and with special machinery, including a new combination respectivess.

Ed son a rubber seed enme from Madaguezar, and the vine is a perennal which grows without repainting and can be barvested annually without further custivation. Both plant and much nery are at it in an experimental stage, though so far the vine has successfully resisted cold

snaps, even hurricanes.

The average person has about sixteen square feet of skin surface on his body according to the Imperial State Institute for Nutrition in Toxic Japan

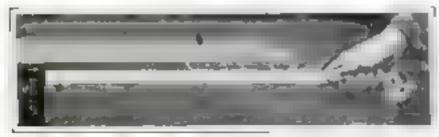
Solving Everyday Problems



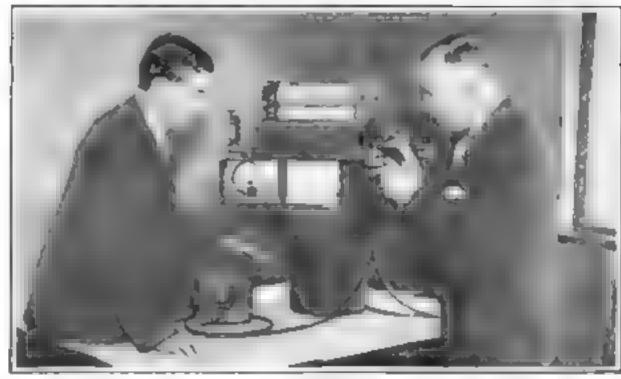
Oulf balls are speedily cleaned by this mechan-Iras washer, and hands aren't sound in the process. To weak a ball the plunger is moved up and down, while the builty cotated between twin brushes in a patented slot in the washer



When a typist tups out a letter on the standard typewriter beyboard of this unique electric machine, she finds it when finished, completely set up in type that imitates ord nary typewriting. Placed in a press. it yields many thousand attract very 'typeweitten' copies of the original letter. Thus costsy typesetting by hand is eliminated



A gir foot mensuring stick no bigger than a watch that a the new metal rule that springs from a small cost to form a stiff, rodlike measuring stack. It is let out to any desired fength, and pushes back into its case like a sword in its ecabbard.



Intended promarky for autitary see, a new acreal convers oveds no operator, but eutomatically taken pictures while the polot numerovers has plane. On each porture is recorded the time it was taken, the angle of the camera to the ground, and the altitude. Designed by Shermon M. Faurchild left, above the ramera maps 180 equare miles of territory without relaiding



Mapped over the point of a pencil, this booky device o a letter opener and point protector combined in one (is flat end for letter opening terminates the percil point. guard. It is kept from turn ing while in use by a slide ring that compresses the burrel to grip the pencil



Utrapped on a golfer a wrist on ingenious device checks his swing before driving. At the top of its ewing, the golf club has attained considerable momentum. To reverse it the fingers are strained, often spoiling the shot. The teather mring check shown above a designed to climinate this strain, preventing overswinging, shoung and booking



Aid to the deal comes to the shape of a new type of electric surphone that lucka like a radio ses. Tweet its diale and bitberto maudible sounds become strikingly clear Not port able, it is for soutalization in homes or offices. The photo at the right above Dr C. W Harper, of Boxtoo, the inventor, demon-

Intercommunicating Phone, Home Bicycle Exerciser, Self-Operating 'Aerial Camera and Other New Inventions





Through shallow shoule where motor hoots have never been before or over accent billions, this about droft boat shows at thirty rolles as hour lies against engine a placed behind the corlinal above the dealy directly connected to the oir propeler. The boat develope as not meeted to the oir propeler. The boat develope as a substantial with all controls on the steering where, while the air and water radies makes steering surprisingly easy.

No more lest instance these new style overalls haven tanged instance equates of conformationship, never on for good, carels in impact to haid the particular ment sendly in place. At the want is detachable backle classes a belt strap, to more a said fit

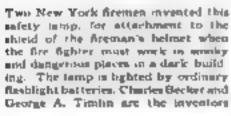


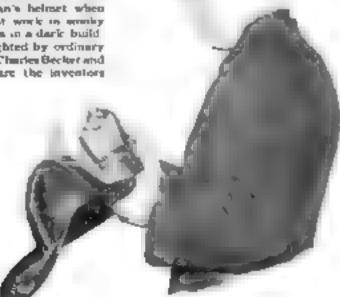
You can ride miles on this bloyds emprises withput going anywhere and acquire muscle and vigor a the process. A specialistic counts the miles, and a friction attachment on the abest rails furth any desired degree of effort to soon the proble





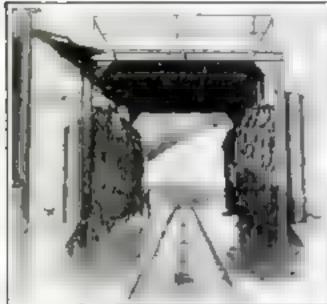
With a microphone at your desk and a foudapeaber at your secretary's, you can give oral instructions at a distance without shouting. Or (his nove) intercommunicating system, substituted for the butter can be installed at home between disting room and kitchen or house and garage. It cans on a six voit dry battery







Revolving around the sitter while a shaft of light throws his features in abort relief from every angle, a new covere camera in a few accords obtains a graphic motion picture record from which a sculptor can make a motur. Todous situage for the aculptor are largely eliminated, besides which the camera will be used to revord permanently the features of permanent of note throughout the world, for the use of future sculptors



Looking they ghother come he are wanted we have been writing introduction. veted with tags

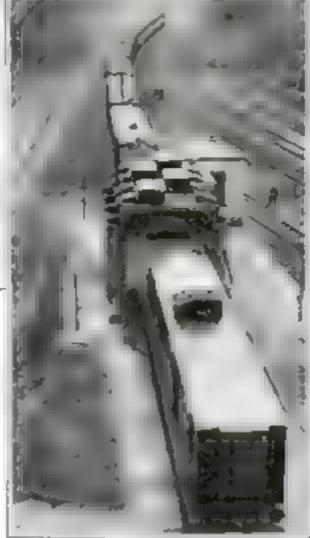


TRAINS on the Paps Lyon-Med I terrament Rai road get their daily back on word as perhaps the orblest wash. r a rachne yet developed - c taked, be structure that can be work of two horsest cars because as train poliscier," if is a term and the and I of a size of the law of the to videing broshes and powerful jetic of water. As the milroad care pass slowly through the tunnel, they are aembled by the brushes and sprayed by the water, to energy clean and ghatening.

Each car remains only two or three turn des a the machine-a striking contract to the time formerly taken by a sumil army of men armed with water pads, scrubbing brushet and rags.

Measures Huge Volcano's Heat

NEW scientific methods are being used to measure the heat of Kolanca, grant volcano of Hawn t I nder the direction of Dr. T. A. Jaggar, decetor of the Hawai Volcano Observatory borogeten feet deep dot the solid rock at the cruter at intervals of a thousand feet. As soon as the temperal res wit on are taken and recorded, the holes are capped with metal rings to preserve them so that they can be used for future observations.

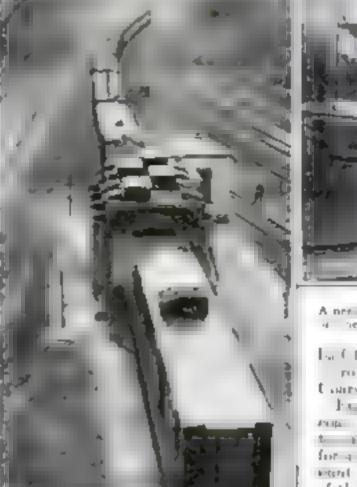


Westing a train in France. The coach passes through the machine in two minutes

Proneers of aviation considered the catapult the only practical method of launching a plane. Langley hoped to laserch lus ill lated "aerodrome Grom a cataputt, and the Wright brothers used one that was remarkably like those of today Now instead of 'taxi mg to get a ronoting shart, paones again are jerkedi into the air by mecoanical means.

Gasoline from Lignite Achieved

TWO French chemists. Problemme A and Hondry amounce that they have made gasoline from lightle in conmercial quantities. Their process of distillation, now a closely guarded secret, is eventually expected to yield a quarter of a billion gallons of gasoline a year



A need a some of water revers the estimate to be or he as we be enverged to all study as all

Isa Classia assistante de la februaria. roa with room loss of landr Contract to a a Appendix

I'm a large want marginal brewn some exact a transfer experts est unite, to a section with or soul free for a species of any analysis all Alema eart deposits accur in the south and west of the Loted Stars now a sest

Epidemics Mild or Severe

SOMETIMES whole tribes of disease germs middenly go on a rangage. 4ke mad men running annick, emissing severe epolemen, according to for Humphrey Rolleston, British physician. He points out that diseases vary from year to year in character and intensity

Though two such outbreaks-influered and measles-occurred last year in the United States, reports just published show that 1920 set new low records in deaths from major diseases, a tribute to progress of medicine and satation

Measles and whooping cough can be prevented or treated by inoculating exposed children with blood from the parents, according to Prof. Rudoif Degkwits, European authority on meades. This practice already has been adopted in Germany Repeated exposure to these diseases has alimidated resistance to them in the blood of adults, Prof. Degkwith declares, making the parental brood an effective agent of animumity.

Invisible Rays Solve Crime

MIMINALS who alter documents s with any ink that contains from can be detected by uiter-violet rays, according to Professor Brüning, Berlin scientist, Postal thieves who open letters and rescal them also are branded guilty by the rays, one kind of murilage, for instance, glown with a floorescent light under them, walle another does not.

Artificial pearls, however skilfully made are revealed as false as are unitation diamonds, the finest genune damonds share with a magnificent purple light under rays of tracidtra-violet lamp.

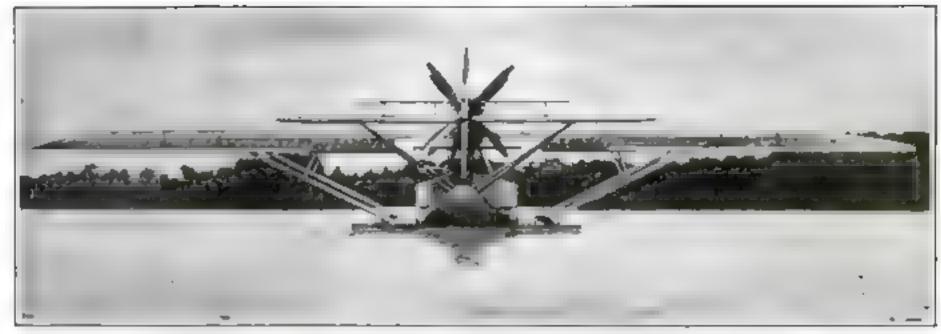
Der tantivo that dark clothed pedestrians walking along roads at mg it propurdize their lives and make autoists involuntary man-follers, the unthur of a bill introduced in the Connecticut legislature would contpel night marchers to carry lights.



Airplane Catapult

Howa all some ern we , sides it a polted the action design plattiere e ce a v shows in the percentarying sketches. This latest cutapull, now in use on he and a teat the shaps, burds a plane from a anover, platform set in movion by compressed atricylinders.





A real or intro-Germany's 130-passenger scaption, seen from the rear after its trial flight over Lake Constance.

Plane Carries 110 Passengers

CARRYING 110 passengers, this mammosth memplane, just completed at Friedrichshafen, formany sped over Loke translates on in trial light at more than 200 pries and lone. A feature of its construction is the langers for phasest propelers, one in front of the single main plane and another just aread of the rudders. It is shown above from the rear

Future planes of this type may be constructed to carry large loads of freight or serve as flect occan liness of the air

Magnetized Area Fine for Radio

OWING to its large deposits of magnetic to received from see Magnet Cove, about eleven mines from Hot Springs Arkansas brings in radio waves with exceptional residts. Tests made with small macrones set upon the large buildings of magnetized rock showed that stations were clearly heard at this point that would be received most feebly in place equally distant locations. Further tests are to be exceed an

Magnet Cove has creat for having the largest deposits of magnetized iron ore in the world. In this area a compass will not work. Surveyors cannot use the tools that are commonplace elsewhere. Small rocks of this area, nat itally magnetized, have been sold to the laboratories of many colleges and achools.

Plant Redwoods in Virginia

GIANT redwood trees, Cablorna's forest monarchs, now appear in Viginia if experiments prove successful. If M bears supervisor of the national forest at Natural Bridge Va is preparing a shipment of California redwood accidings, to be planted near Natural Bridge. The trees are prized for their lumber, which has great durability

Flier's Chief Requisite-Nerve

WHY can some men fly safely, others not? What qualities make a good amplane pilot?

The belioot of Aviation Medicine, San Intonio, Tex., has undertaken to answer these questions. To this end they are aided by a remarkable instrument which tells the speed with which a man reacts to signals in color, light, and sound, and the speed and coordinabase of his may ements.

The chief requirement of a good filer, according to Capt Neevy C. Mashhum chief psychologist of the school, is 'nerve.' To determine a prospective filer's nerve has personal instary is studied exceptly. Major Francis H. Poole, onef of the school, recently expressed the belief that mucty percent of accidents are due to the pilot and not the plane.

Why Candy Explodes

Sometimes candy explodes, and now and then confectioners find whole shelves of chocolate creams that have burst open. The cause according to scientists of the U.S. Bureau of Chemostry, is yeast in the angar filling. Occupary yeast, like that used for making bread, will not grow in angar, but there is a special yeast that finds the sweet creamy mixt we ideal. Its fermentation produces gas that bursts the candy.



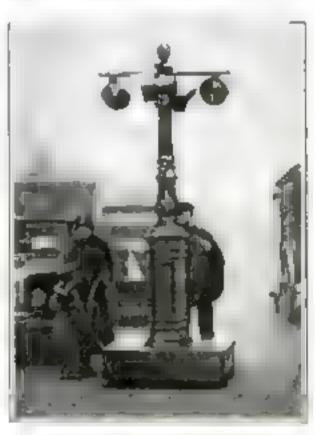
Radio Set for Aviators

A DISABLED seaplane drifting at sea may broadcast an appeal for help with the newest air, lane radio, pictured above, designed by the U.S. Navy for just such an emergency. Small and compact, it is operated by a hand generator, and so works even when the plane's motors are dead. A set of quartz crystals confides it to transmit a steady signal on one of several different wave countries.

In the disstration. He set is seen at the left, the hand generator at the right,

African Bird Fades in Rain

BRIGHTLY colored when the sun brid recently studied by Dr. I. Krunibiegel German b ochemist, become a sudspectacle when wet by the rain. The brilliant dye of its red feathers fades to a pale pink, the leak being caused by the annihous in rain water. Food the hed eats probably furnishes minute quantities of the natural dye subgredients, says Dr. Krumbiegel. Known as tiracrie, the dye is a conspound containing copper.

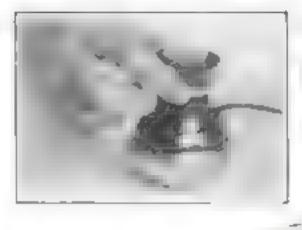


Paris Tries Portable Semaphores

PORTABLE traffic semaphores are belong solve the traffic congestion prometo in Paris. At specified hours of the day they are moved to street intersections where congestion is leaviest during the business rush hours, for example—then at hight they are curried to the Diester districts, and on Sundays and bolidays to crowded intersections near the radway stations. The first of the new signals to be tried out is seen above at one of the businest tripsings.

Those who come there own break are with appreciate this compact electric bet plate that prepares a most of a may A describable handle saves space and burned fragers

Tools that Lighten Home Tasks



Tak it up and a lights put drawn and it goes out. This bowl in reality an electric match can be were current for a shura soft of Assays tendy a glits a significant setty.



Round, square or eval case are opened with this ingenious tool. Its two handles at a the cast a rip with a roller and a latting wheel. A few turns of a reask and the tip of the cast design off class can be even, the total on the cast

exight. This dish master to she makes sheet needs of the dishes to the sink. Attached to the faces by a righter elementers, it cent to me a scap chamber that additioned to the bot mater flowing m. st. The break is extra node.



A named pie crust in teruses loops of fleshie with to blend about and and flugs it is how! of any are. Also min es, chops and creams food

(Below Press a button, and this remarkle electric device mises therein or saind decemps, beats eggs or whips cream. With its adjustable stand it for howh of any use. Two sizes of beaters adopt it to a vaccity of uses



When there am's much recent to space this election task the act attended and in contract. Ad another make the copies little space open, much less closed and it can be taken apart for storing or packing. Light in weight it is exactly bandled and moved about

Any bethink with a standard fauret can now have a shower by the simple attachment of the beariest device. A honged metal arm, clamped to the fauret of to the wall, holds the spray notple at the desired height. Rubber hope essences notice and fauret.

Two New Dish-Washing Devices, Can Opener, Faucet-Operated Cream Whipper and Other Novel Inventions



With one blade notched and the other straight these new shears save the family accessors from nicks, cutting picture wire.

Petow Bilver magazily loots to the title. placed to a dish and togething a new attimicity, place covered, with his salsons solution. The magazined is an elect ochtomical true suff



But he long life this fiedged can opener uses buste at a line. When is dull the other is ready service. Two buttle opecomplete the double life.



Ship back the top of a new kitchen table and out comes on froming board. Occurrelly hidden benestly the porceints table top, the disapptoring board swings into a convenient position for use

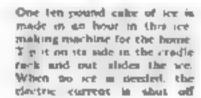
theft. A graceful new elect. In the follest when fills is with water once dainy and

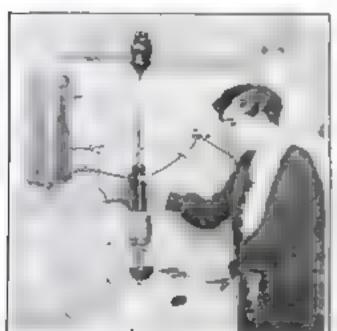
the ender bereinste not it

then proged in the ele-



Milik bottles become pitriers with the attachment of this lid to its neck, Thit the bottle, press that pluriger, and a attents issues from the spoot.





While hot water courses through a tube at this movel dish washer, its spinning electric brush in passed by hand over the dishes, removing and accepting all food. The device is hing by a wash cord from a weightful pulley to make it easy to make it easy to make in may direction

A to bed to the let then fauet an oign, it mights to we term a set quester to be work of senting edge with roung command or in 11 fits any tare and wateries a small enter turitize has above he blacks that it. The mixing



World's Oldest Book at Last Deciphered

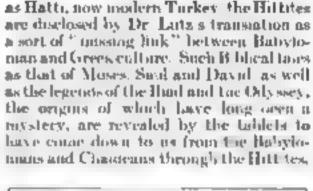
hitherto buffling mysteries of ancient

The tablets were dug up in the rouse of the Hittite capital near Augues, Turkey, with other letters and documents, all inserbed on auchaked clay and filed away just as a modern business firm keeps its records. The writing was done while the clay was soft. When a tablet was to be sent any distance, powder was sprinkled over the text and the tablet wrapped

> in a soft, wet, clay "envelope." The powder prevented sticking, and the recipient broke off the clay wrapper with a thin chied,

> The text, as Dr. Luta found it insder the clay envelopes, was in the cunesform or darthits characters of ancient wittings.

three natives of the country known





Bushe rock eneving, aboveny Behylman influence. It represents a priest energing offerings

Dr Lute, who has deciphered Histist well ings 4,000 years old

AIDED by a sharp closel. Dr. H. Lats, of the University of California, has just finished reasing the oldest book known to man. The task has taken him twenty years. The closel was necessary because the "hook" is a series of clay tablets, about the size of a pocket notebook, each incosed in a baked clay sheath,

which had to be chipped away by the sharp tool. Dating from a period between 2,000 and 2,300 years before Christ, the book is part of the records of the bitle-known. If this Empire, and explants



Map of advent to by by the parties that the by by the parties that the byth the byth

ter to an income graphic processing and an appropriate and an appropriate and an appropriate and a second and

Cusetform writing on Hettite tablets, now de ciphered. It is reed wartically, lop to bettem

Winners in Our March Stomachion Contest



Penpagivana



IN OUR March issue we offered \$100 in cash prizes to readers submitting the best original designs on the subject of "sports" made from the fourteen pieces of the Stomachion puzzle game of Archimedes. A number of the prize winning entries are reproduced here. The prizes have been awarded as follows:

FIRST PRIZE, \$25—Thomas D. Young, Frankfort, Ky. SECOND PRIZE, \$15—J J. Leahy, Medford, Mass.

THIRD PRIZE, \$18-Louise S. Lovert, Weaverville, Callf.

Five Prizes, 35 each

Horace F. Bell, Erse, Pa.

W. M. Mullius, Richmond, Va.

Karl Steding, Wilker-Barre, Pa.

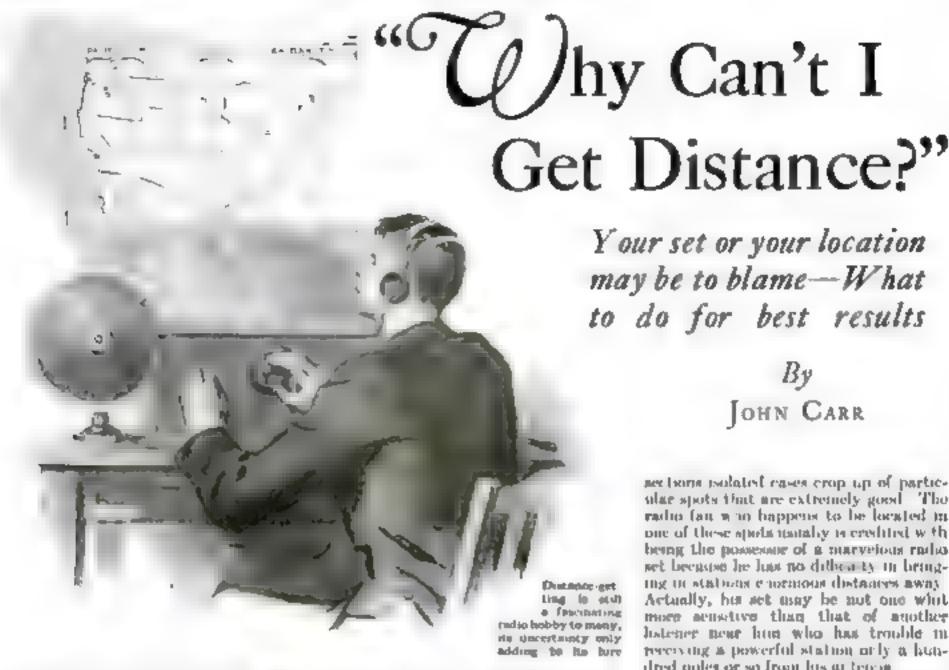
Ten Prizes, \$2.50 each

E. V. Bowers, New Ross, Ind. Clarence W. Carroli, Rochester, N. V. C. L. Untchfield, New Brighton, Pa-Robert E. Despard, LeRoy, Minn Mrs. C. S. Dackmann, Minneapolis Hattie M. Little, Schastopol, Calif. Mrs. Ethel Reed. South Bend. Ind. H. N. Toftoy, San Antomo, Texas A. P. Wilson, Penheoke, Out., Canada Wm. J. I to. Sonta Cruz, Calif.



Tennis Player
Second
Prize
J. Leahy
Medford, Mass.





T'S all very well for people who live in big cities to claim that radio fans no longer want to loten to dis-- tunt stations, but the fact remains that a large percentage of radio lastenera in this country must either bring in farawny stations or a satedactory canner or else go without radio entertainment alt agetions

If you are one of these or still feel the fasculation of letering to far-off stations, and have difficulty in getting worth while results, what sito he done about it?

hard determine the cause of your unsatisfactory results. Fan ty radio equipne it may be to blame in which case the remedy as comparatively number. If onthe other hand, poor distance reception is a characteristic of the locality where vost live, you may be getting all that can be expected under your particular set of conditions.

Prop distance reception frequently is due to an madequate antenna. Distance reception is always best on the lighest and longest antenna you can put up. Of course, an extremely long antenna does not give the best selectivity, but if you must have distance the long autenna will help you get it. The mere fact that someone else is bringing in stations from Canada to Mexico on a thirty-foot antenna is no guaran ce that you can do the same thing the other fellow may be located. where reception is particularly good. So the first step, if you are not satisfied with the introduct of stations you can bring to is to see what can be done about improving your antenua.

Assuming that your batteries are all good and that there is nothing actually proken or disconnected about your re-

cerver, the next step is to find out if the tubes you have in the cadio-frequency and detector stages of your set are as good as tory should be. Take them to your radio dealer and have them tested, if that is ant passable, borrow a set of tubes from some neighbor long enough to determine if they improve results. The tides in the nucleo stages of your set may be responsible for poor values, but they have both to do with distance

There is no way to predict in advance what kind of radio reception you are going to get if no receiver has been operated in your particular locality. That is why it is unfair to expect a radio set manufacturer to guarantee in advance that you will be able to get distant stations with any degoe of certa cty. All that may maker can do se to pron ou you that if it can be done, his set will do it.

OF COLESE there are sections of the country where reception in ante uniformly good over large areas. If you happen to live in such a section, your dealer can tell you in advance what stations are likely to be received best, but he can't he too definite even under these conditions. There a ways is a chance that some peculiarity of your particular locality may upset his predictions.

Experience has shown that it is possible to generalize on the possibilities of disissue reception in certain sections. For Distance most of Westchester County in New York State is rather poor. Large areas in the middle west, notably in Obio, Illinous and Indiana, are remarkably good. But even in good acctions there are instances where distant stations are rarely heard, and in otherwise poor

sections isolated cases crop up of particalar spots that are extremely good. Tho radio (an a no happens to be located in one of these spots untally is credited with being the possessor of a nurveious radso set because he had no dithea ty in bringing ite stableus e normous distances away. Actually, her set usay he not one whit more sensetive than that of another listener neur han who has trouble in perceiving a powerful station only a hundred notes or so from his ai terror

JOHN CARR

No one, not even in a favorable locality, can expect to get considers reception from stations thousands of pules away during the daylight hours. It can't be done with any type of set made. In fact, operators of the most powerful broadeasting stations in the country declare that they can be absolutely sure of reaching between at any hour of the day or a got only when they are not more than one bundeed unles away.

While you a ways can expect greater range at night than in the daytime, some nights are much better than others. Frequently there will be several nughts in a row which you seem to be abluto get any non-er of distant stations. Then there may come a period of a week or two when the air seems totally dead

These changes in the strength with which distant stations are brought in give rise to remarkable effects. On one night you may note that stations from one direction are received with considerable intensity. The next night stations in the opposite direction occupy the center of the stage.

TNDER theoretically perfect conditions, stations are heard best when they are in the direction opposite the free end of your antenna. If you partieslarly desire to receive certain stations. try the effect of an antenna pointing away from these stations.

The uncertainty amout distant radio reception has one redeeming featureif the uncertainty didn't exist thousands of radio fans who now sit up all nours of the night trying to get distance would find that their bobby had lost one of its greatest fascinations!

New Ideas for Radio Fans

How to Get C-Current from B-Eliminator, Cut Out "Motor-boating," Decide Correct Antenna Length, and Other Hints

The current consumed in the Consents to so little that the first amounts from the last amon amplifying stage of the radio set, has brought up the question of what to do about the C-battery. Power tubes require from time to forty volts of C-battery. The current consumed in the Consents to so little, however, that the life of a dry cell battery used on these order it is just about as long as it would be if it stayed on the order's shelf

You can silve the Chattery

DET AMP POWER

ELIMINATOR

Fig. 1. How to get C voltage from

your Beliminator by using a

pariable remainner and condence:

problem effect by using a dry cell battery of the proper volt ngs and employing the Barbin tontor for B voltpages or ly or you ran, Lateler cerline concritors, obtain both Band Congreent from the Behnimater. The sepmale battery on the Cerenit is the smaplest and righed method.

If you want to get the C-voltage from your B choosed or, try the circuit shown in Fig. 1. The heavy duty resistance shown in the diagram should be capable of carrying at least fifty indhanopered without serious overheating, and it should have a total resistance of about 2 000 plans if you require a C vostage of from twenty-seven to forty. The fixed condenser shown should have at least two mid, espacity, lower values of capacity may cause some him. With this cir-

cost the C voltage is, in effect, subtracted from the B voltage available on the power bracking post of the eliminator. Consequently the arrangement is practical only with the more powerful types of B-eliminators.

After you have booked up the apparatus as shown, set the knob so that the reastance is all in use, snap on the radio set and B-ch it mater, and then slowly turn the knob until volume and tone quality are best. Don't turn the knob any farther than necessary to get proper volume and quality, because if you cut the resistance down too far the C-voltage will be too low and the life of the power tube shortened maternily.



Fig. 3. Use an asbestos shield on your soldering iron, as shown in the photo, when working in tight piaces to prevent burning the insulation from advances wires

PIN ON SIDE OF

TUBE BASE

This apparatus will work on any type of power tube, the only difference being that on tubes that require relatively low C-voltages, you will have to turn the knob farther from the high resistance point

Don't Burn Wiring

IN WIRING a radio set you are sure to run into places where it is almost unpossible to

get the soldering from in contact with the wires you want to solder without pressing the hot body of the from against the

spagnetti tubing or other insulation on indjacent wires. Burning the insulation in this way can be avoided by constructing a simple should (Fig. 2) consisting of a roll of sheet asheston tied with wire that can be slipped on the

icon while you are working in tight corners. Do not leave the covering on the iron longer than necessary to make the difficult joint. If left on too long, the iron may burn out. Potting the cover on the iron when you first turn it on will help in heating it up.

How to Stop "Motorboating"

DIFFICULTY often in experienced in operating a set ecoupled type of nucleo amplifier by means of a standard B-hattery

channator Either the quality is poor or there is that peculiar "pat-pat pat' effect micknamed "motorboating." Increasing the condenser capacity of the Bachmanator, as abown in Fig. 7, sometimes effects a care. Use condensers having a rated working voltage higher than the maximum developed by the channator. Adding expants also will improve the quality.

If the motorbouring pressis even after the extra condensers are connected in the circuit, try reducing the value of the resistance of the grid leak on the power tibe, This can be done simply enough even when the resistance constell arm ifter is

of the inclosed type, by fitting an extra gnd leak chp as shown in Fig 4. Locate the gnd term in of the power tube. It always is the contact on the socket nearest to the contact pin on the base of the tube counting to the left. In other words, when you are looking down into the receiver the grid prong of the tube is just to the left of the pin on the side of the base.

A .05 megohin grid leak in the clip will be in paradel with the grid leak inside the unit, and you will not find it necessary to go lower than this value. The correct value for the extra grid leak is as high as possible while yet stopping the motorboating.

Light for Your Dials

MANY types of commercial receivers are now made with special arrangements for illuminating the dials. Special



Fig. 3. This new style dial light includes the filoment switch and can be added to your set without steressing the number of pastel boles.

d als with lights hold in are available to the home constructor of radio sets. In addition, there are several styles of panel lights that can be applied to sets already resistracted to obtain the same effect. One of these is shown in Fig. 3. In this particular model the panel light also performs the function of the filament switch so that you can substitute it for the filament switch on the panel and thereby save drilling new boles. A knurled knob turns the light and the tubes in the set on and off in the usual way

Wire Skinning Pliers

Di RING the days when hare has were was most popular for wiring radio sets, any type of plices was satisfactors. The fashion now is to use insulated were Consequently time must be speat acraping the insulation from the end of the wire at each joint or connection. You can save sourself this trouble by fixing your were afters so that they will serve to skin the wire. Take a sharp-edged oilstone, and stone a little groove in each cutting edge just deep enough so that when the jaws of the enter are tightly closed they will not cut hare wire of the size you intend to use. To skin the end of a piece of wire,



Fig. 6. Adding a fixed constensor across the loudspeaker constitute improves loor quality

place the end at the notched point, close the pheri and pull. The resulation will be cleanly stripped off. You will find that there is room for several notches of different sizes to correspond with the various wire ages you use without speding the phere for ordinary use.

As shown in Fig. 5, the best location for these small notches is near the pher joint so that the ends of the cutting blades will be available for regular use whenever they are needed.

Try This to Improve Tone

SOMETIMES a worth while improvement in tone quality can be obtained by connecting a fixed condenser across the loosispeaker terminals as shown in Fig. 6. Copneity at this point in the radio circuit tends to reduce the strength of the and ble tones at the upper end of the scale. In other words, a condenser across the loudspeaker terminals reduces hissing noises to a marked extent, shall timey reissed notes are subdued, and the lower tones are not affected to any noticeable degree. If you prefer the deep-throated effect, you can get it by a condenser arranged in this way.

The value of the condenser depends on a

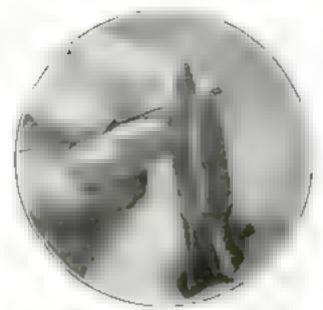


Fig. 5. Stripping the insulation from the meds of wors is quick and easy if you stone notrices of the proper size in your wire cutting pilers

number of factors, so that the best way is to try several until you strike one that works best according to your own cars. A condenser of .0005 m/d, in about as small as will accomplish anything at this point, and you cannot go beyond .01 without causing a considerable loss in volume. Small pieces of wire can be soldered to the lugs on the condenser and inserted in the

> plug with the loudspeaker cord tips.

Cutting Out Electrical Interference

THE question as to whether anything can be done about channating scratching and bissing noises produced by local electrical machinery depends upon the nature and location of the machinery causing the disturbance. The general impression is that reducing the length of the auteom or using a loop will in-

Often, however, nothing at all can be done to improve matters. If you live near a trolley line and attaching noises are produced every time a trolley goes by, the only remedy is to move away.

To Increase Selectivity

ANOTHER use for small fixed condensers is to increase the selectivity of you find difficulty in separating stations on adjacent wave lengths. The simplest way to connect a condenser at this point is shown in Fig. 8, and this illustration as well as the one in Fig. 6 shows the correct way to hold a small fixed condenser while soldering a wire to one of the high. The condenser always should be grasped by the phers on the metal part opposite the side where the lug is being roldered, as otherwise the metal of the phers absorbs the heat from the metal of the condenser and prevents it from getting hot enough to take the solder

In order to obtain any appreciable increase in selectivity with a series a itemia condenser, very small capacities must be used. Try 00025 mfd, and then .0001. If the results with are not substantory, we two .0001 condensers in series.

The effect of a series condenser used on this way is somewhat the same as cutting down the length of the antenna. Consequently, soldering a condenser as shown is desirable only if you want to effect a permanent increase in selectivity as night be the case if the only available place for the auteuna resulted in log long a stretch for best results in your particular sociaty

A condition exactly the reverse of this, that is, where you are located far from the broadcasting stations and you can erect only a short antenna, rectired different treatment. In this case selectivity is of less importance, while again strength is what you are after. Fre-



SET

Fig. 7. Extra capacity added to climin a last stops to otor boating."

prove matters, but this is not true in all instances. If, for instance, the interference is caused by machinery located in the same building with you, putting up a longer and higher outdoor antenna may effect a considerable improvement. In

this case the ratio of signal strength to the strength of the interference is changed for the better. It is also a good idea to change the location of your antenna if that is possible. Interference produced by machinery outside your own hudding may be reduced by the use of a shorter antenna, especially if you can move the antenna further away from the source of the noise.



Fig. 8. The adectivity of a long enterms can be necessard by connecting a condenser in series

quently a considerable increase in signal strength can be obtained by adding a coil of wire to the autenna circuit in place of the series condenser. The minimes of turns will depend on the length of the antenna you are using and also so local conditions which govern the natural wave length of the antenna. Try twenty five turns of ordinary well were bunched into a coil roughly three inches in diameter.



The volume of peatints from neighbors depends to inverse proportion on the hind of music inflicted on them. Excellent tons quality is possible from a small outfi-

"IF SOMEBOD's doesn't murder that bird pretty quick. I'm going to do it myself' shouted the rest occupant of the third floor back. The rest of the boarders unminimously agreed that violence was called for -the moner the better

Meanwhile the cause of the impromptuinfiguation meeting was folling back in his armebate enjoying the hideous wails and thrompings of a fourth-rate jats orchestra rumbling forth from an antiquarted for horn type londspeaker.

His situation was not unissial. Countless other dwellers in boarding bouses and hotels, actual or potential radio lines, are faced with the same difficult problems in their search for adequate radio entertainment.

One of the most important is good tone quality. The volume of protests from neighbors depends in inverse ratio on the kind of music inflicted on them, the better the music, the fewer the kicks.

Luckey it is possible to obtain excelleut tone quality from a reasonably small
and compact outlit that will take up little
space and be easy to move when the time
comes for a shift to another residence.
You don't want great volume anyhow
because you are bound to have some
neighbors across the ball who don't care
for music of any degree of excellence.
Besides, with low volume requirements
you do not need the larger power tubes
which call for extremely high B-battery
voltages.

Everything considered, you will find that the 199 type tube has the most favorable characteristics if once and portability of the receiver and modestal estamment are important. With 199 type tubes in all of the sockets of the set except the last in which you should use a 120 type dry cell power tube for the sake of quality, the receiver can be made small and the heavy, six volt storage buttery mested to supply the filament current for the larger types of tubes is not necessary.

By JOHN E. LODGE

You can run a set fitted with several 199 tubes and one 120 tube on three ordinary No. 6 dry cells, such as are consected to the door bell, or if the places where you expect to live are supplied with electric light current, you can buy an 1-power outfit consisting of a small light, two-cell, four-volt storage battery and a trickle charger

FOR a B-battery you will need medoundaty forty five volt blocks of dev cells and one twenty two-and-one-half volt block to use as a C-battery. Still further economy in supplying current to your set ran be obtained by the use of several sets of three dry cells each connected in parallel to light the filaments, if you use the set an average of several hours a day a small, high grade B-battery channator will save space and money

The size of the set and life of the dry cell A hatteries and B-hatteries depend on the number of tubes in the set consequently it is better to purchase or build a set with the fewest number of tubes consistent with the results you want to obtain

Most of the standard types of radio

sets now on the market can be used with 109 type tubes. In fact, all modern radio sets are unde with sockets of the UX type which will take the new types of either storage battery or devicely tubes.

While the larger types of cone loadspeakers give remarkably perfect tone quality you may not have space for mach an instrument and, besides, a large cone requires extreme care in handling. It would prove a nuisance to pack and move from one place to another. Horn type speakers are more rugged but have the diradvantage of pour tone quality, expecally in the smaller mes. One of the small size comes would appear to be the hest relection. If it is absolutely necessary to keep the rise of your equipment to the lowest possible mammum you can dispense with the loudspeaker entirely and use a phonograph loudspeaker out fastened in a corner of the ceiling with the diaphragm toward the corner where the ceiling and two walls meet. Quite acceptable results can be obtained in this way both for volume and quality

OF COURSE, if you do your receiving with a pair of beadphones, a great saving is effected in the size, weight and cost of your whole radio equipment. In addition, you certainly will never annoy the most sensitive neighbor.

You will need some kind of antenna unless you purchase an expensive, loop operated set. If you cannot get permission to put up a temporary outdoor antenna, string a piece of bell wire around the picture molding in your room.

Sam Loyd's New Puzzles

How Fast Can You Think?

Seven Brain-Teasers to Check Your Abilities



Have You Imagination?

"A hundred and fifty when joined to a tere."

Makes a flue garment to warm you or me."

That complet fits the picture above and poses a riddle. What cosy-sounding garment is suggested by the sketch?

Rebuses and raddles are a test of your wit and imagination. Try to solve this as q or k y as possible, then turn to page 130 for your rating.

Can You Analyze Facts?

FOUR little girls and there four brothers divided thirty-two apples maning themselves as follows: Annaget one apple, May two June three, and Kate four. The boys manings were more complicated. Ned Stattle rese ved as many as a sister. Then Brown twee as many as his sister, Bel Jones three times as many as his sister, and Jack Rommson four times as many as his sister.

From these facts, can you figure out what must have been the arrannes of Vin. May, Jane and Kate? Aside from the comentary mall constants involved the problem on is for ability to pursue analysis beyond orthodox formans. The solution

is found on page 130.



Are You Quick at Figures?

THE call for a standing vote, Mr. Charman," reported the secretary at the Rotary Club meeting, "showed that the motion was carried by a plurality equal to one third of the opposition. But as that result, it develops, was due to a lack of chars, preventing eleven members from sitting down to register

their votes in the negative, we wish to report that the apparent numerity actually defeats the motion by one vote."

From the secretary's report, can you tell how many votes were east, pro and con, and prove your queckness at figures. Find your rating on page 139.



One for Mental Bookkeepers

TWO anters have found stan agreeable plats to pool their allowances and do their allopping logether. On one of their escent visits to the stores, Martha bought a hat and a pair of shows for \$15. Then Gertrade paid as much for a thouse as Martha did for her hat, and invested the remainder of their money in a parisol for hereaf

On the homeword trop. Gertrude who had been "thinking over" a remark of Martha's about her blouse a cost og as much as Martha's shoes had cost \$1 more than Gertrude's parasol. "That a true, agreed Martha, "and if we had apportuned the blouse and shoe money so as to make your blouse cost half as much again as my shoes, then our lotal expenditures would have been equal, 'lifty-fifty,' as the boys say

From the facts given, if you have an aptitude for analytical bookkeeping, you should be able to give the respective costs of the four purchases in a few minutes. Time yourself, then turn to page 130.

SAM LOYD, the world's most famous puzzle man, offers these brain-tensers from month to month in Popular Science Movinly in response to requests from hundreds of readers. To use them as real tests of your mental ability, time yourself is solving them and compare your time with the ratings on page 139.



Are You Observing?

IN THIS account, the balance point is exactly in the center of the beam, and the elves are tectering in exact balance. Now, if all the boys in the two groups were scated on one arm of the scenaw, how many girls would it require on the other aids to effect a perfect balance? Of course it must be assumed that boys weight alike and girls weigh alike.

Your speed at solving this will test your aptition at grasping and resolving visible evidence. Turn to page 139 for your

to lang

A Test of Vocabulary

WHEN a peacer "beliewls" a word, he removes the first letter. Here, then, is a test of your vocabulary and quekness in visualizing words. Believed:

A word meaning to desire and leave one meaning to act treatmostly; a wooden case and leave a price; a tale and leave efficient, a measure and leave a communition; an injury and leave a limb; a culinary concection and leave a readire; part of a look and leave a marme creature; a scoundrel and leave the middle of a church,

Time yourself, then turn to page 139.



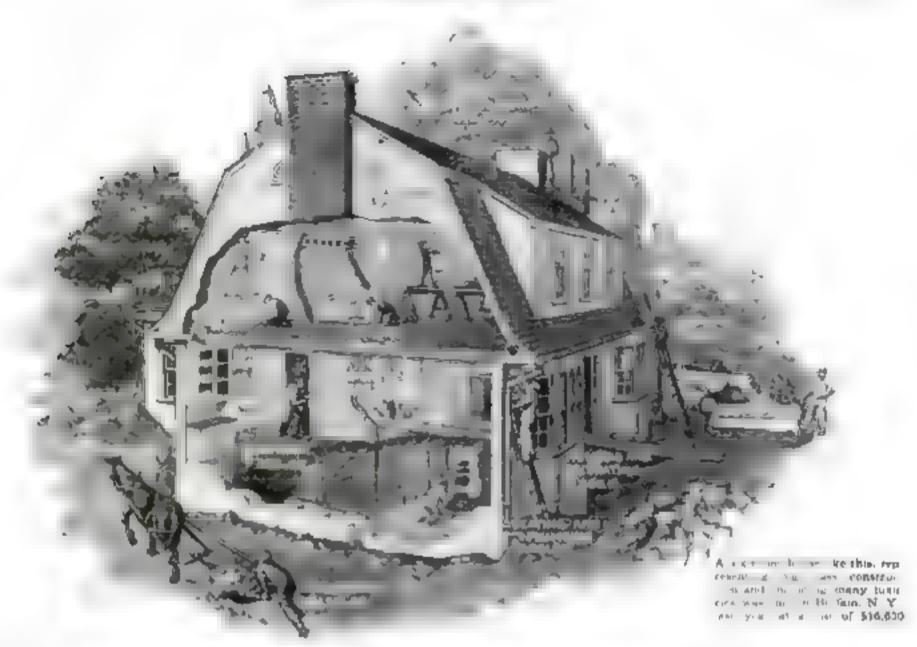
Have You Keen Sense of Form?

A battle flag of the Zulq Navy. From a possier's atsodpoint, the advantage of the Zulu ship is ready to surrender and send the symbol of defeat to the maintop, a square white flag can be nicely constructed from only two pieces out from the white parts of the battle flag.

Discard the rectangular dark central section. Then divide the requiring white part into halves, of exactly the same shape, which will fit together to produce

the white square.

This is a rather difficult test of your sense of form and proportion. Time yourself, then refer to page 139.



What It Costs to Build

Facts and Figures about Materials and Labor That Will Help When You Plan to Construct Your House

The other day he asked what f would think of him if, when I asked what it would be ready and what it would cost, he replied: "Maybe in a few weeks, maybe some time next fall. I never promise any time. Don't know the cost exactly, fifty or seventy-five dollars, perhaps. It might even turn out to be a hundred dollars."

I told has I'd timek him erasy.

"I am having a bouse built" he said with a grin, "and I'm just trying out on you the line of talk the building people give me. I can tell customers that but tons, buing and wages may go up or down that I couldn't promise a delivery date because unexpected conditions might arise. But I don't. Why isn't a house like a nut of cottees."

Rightly or not many persons share the certical sentiments of my tailor in regard to nome building. "What will it cost" is something of a popular riddle and there are many obvious reasons. Houses differ greatly in themselves and in the conditions under which they are built. Most of them are individual hand jobs. Their materials are retailed at all sorts of prices and wages vary widely between Mobile, Boston and Scattle.

JOHN R. McMAHON

But there are two common methods of extunating house cost. One is based on surface area, or square feet, the other on volume, or cubic feet. Both are rough but useful.

In estimating by the volume method, you multiply length, width and total height of building from cellar floor to roof. Add roof contents in cube feet for an ordinary peak, the roof contents would be half the roof height at ridge multiplied by length and width. Dormers can be treated as small peaks figured separately. Finally multiply the total volume by the rost per cubic foot of that type of dwelling.

SOME idea of the cost per cubic foot of different types of dwellings may be had from the following figures, covering an eastern metropolitan area last year (they do not include contractor's profit, which may amount to ten percent more). Bungalow of three or four rooms without basement, 32 cents per cubic foot, frame dwellings built by a speculator, 40 cents; a storeo residence, 43 cents; brick house

termed semificeproof. 44 cents; rather ligh class masonry dwelling, 49 cents. It may be interesting to compare with these figures, 28 cents for a garage, 54 cents for an office building and 92 cents for a first-class hotel.

IN ESTIMATING the lastice cost by the area method, onto de walls are considered. Using this method, one expert offers 01 cents as the square foot cost (minus conteactor's profit) of an or taide wall in wood frame, with sheathing paper, aiding, lath and phater mane and three coats of paint outside. A similar wall with shingles materal of siding crosstwo cents a square foot more. If the outsule covering of the wood frame wall is stucco on metal lath, the price jumps to 86 cents a square foot. Some of the extra expense is due to the high grade water proof paper under sturce, also furring labor and material. Frame with face brick veneer amounts to 97 cents, while a solid eight-inch wall of common brick farred and plastered inside, is only 86 rents. Hollow tile, eight inches thick. stucco outside and plantered directly maide, is 93 cents. Concrete block costs something less than hollow tile. While

the figures show a large difference as to outside wall costs, it is asserted that, in relation to total building cost, meantry is only six or eight percent more expensive than wood frame.

H. OLSON, vice presi-La. dent of the American Appraisal Company, telis me that his concern uses neither the ordinary volume nor area method described, but buses its cost estimates on wall permeter and living floor space. Wall perimeter means amply except measare. Living floor space excludes all nonliving space. such as the otte, basement or elsewhers. All bathrooms, recreation rooms and finished rooms in general belong within the definition. On this bases, Mr Oboq estimates the cost of a present-day house at \$5 to \$8 for each aquare foot of living floor

space. Thus a house 30 by \$5 feet, in-sile mensure, two floors usable, would cost \$10,500 at the lower rate and \$16,800 at the higher figure, which calls for more expensive material and workinanship,

These figures check up fairly well with others based on building area. The nctual cost of a first-class dwelling was found to be \$13.00 per aguare foot of holding great the detail costs per square foot of building area being as follows:

Excavation	80	23
Matonry	- 4	110
Rough framing (wood, metal latts		
gard at meco)	- 4	25
Interior finish	- 5	Dis
Plumbing (brase pipe for water		
aupply)	- 1	1911
Heating (hot water, conf furnace) Electric lighting, with fixtures	- L	4 kg
Electric lighting, with fixtures		N.J

Total per sq. ft bushling area \$13.00

Cutting in two the interior finish item, which in this house melided fare and bixurious details, the bosse belongs in the class previously described as worth 88 per aquare foot of livable area.

NUMBER of su-called model houses A were built last year in various parts of the country by the cooperative action of newspapers. Irade interests and various are rifectural anstitutions. One of these was constructed at Birlam, N. Y. having aux rooms, the materials being brick, half tamber, stucco and asking. Its cost was distributed thus

Excuvition and foundation.		
metuding garage and cellar	81.510	00
Carpentry and millwork Cul-	62.010	240
dorum whate pine for ex- terms and usale true, fiber		
board and lating hardwood		
(Const)	3,737	45
Plaster, three coats on fiber		
manlating limber	452	20
Brickwork, and street outside.		
turee coats open freplace,		
memerator with chimney	2,011	10
Tiling, bathrooms, hearth	216	30
Plumbing, brass pine for water		
supply, automatic gas heater		

for hot water

\$8 **65.0**,1



How to Figure the Cost of a House on a Basis of Its Cu. Ft. Capacity

FIND total cubic foot expects; multiply this by the accepted cost per cubic foot for your locality. For example, taking the above house:

House below attic. 28x36x21 = 24 192 cu. ft. Roof, 28x36x4 12 height = 4.052 ca. ft. Total capacity, 28,2. t ca. ft. 28,221 + \$ 40 - \$11,289,60 Total cost in frame. 43 = 12 ± 16, 32 sturro, * brick, 20 44 = 12 cc8, if

These cost-per-cubic foot figures, 40, 43 and 44 cents, are accepted costs in an eastern metropolital area.)

Heating, steam, oil lawner Booting asphalt shangles	\$1,636	2.5
copper flatteing guiters and		
lens lern	395	50
Electroni work	68.5	10
Windows, steel frause; plate		
glass; weather simpping	786	91
Hardware, looks, etc	233	
Painting and decorating to	2000	
chiding linoleum	1.060	13
kitchen component, gas range	3.311	
		25
Window shades and erreens	6.1	273

Total labor and materials #16,655 11



With building nontrials and labor doubled and even impled since 1913 a house built today costs at least twice as wuch as the same hopse built before the war

These figures do not include the arclatect's fee, contractor's profit and various sundries. It may be noticed that little was spent on the cool compared with the heating plant. Other items, also, might be adjusted to purronal preference.

IN INTERESTENG contrast with the Buffalo house in another six-room house erected under like auspices in a gulairb near New York City, Though specifications for both lucuses were a sout the same, labor and materials for the accord house rost #2 of more Exrayatson and foundation were \$150 less than for the Buffalo house; carpentry and nol work costs were almost identical; while iaso to plasterthe cost Wisa more on the Mantie seaboard than on tie shares of Lake Erre. Such a substantial difference

must be attributed to the wage factor. Brackwork and stocco outside were \$61 logher at the seaboard location. Extra tiling in the latter case—in hathrooms up to the ceiting and in kitchen up to a height of four and one half feet accounted for \$900 more on thus item. Plumbing was \$233 higher on the coast,

Heating with oil bur fer was \$554 more expensive, but this difference can be explained by the mota lation of a hot water system instead of steam. Roofing of the same nort was about \$100 less in the eastern district, and this difference was almost precisely reversed on the stem of electrical work. Windows of steel frame were 203 higher on the seabourd.

Hardware was \$132 elseaper on the first dwelling, but this item luor a wide variance anywhere on account of quality. Painting and decorating were \$18% less in the metropolitan area.

THE last stem, window shades and screens, seems to reveal a starting extra charge of more than \$300 for the saborbs of New York. However, the specification of broaze wire screening to for latter case goes a long way toward explaining the cost. It would at k appear that with an allowance of \$2 per shade, the screen doors and window screens of this bouse would cost between 68 and \$10 agrece.

knowing the price of materials and the rate of wages, the lag question remains, law much can the worker accomplish per hour or day? Quality counts in banding a house, and a too hurried job is bound to be poor. Nevertheless an approximate estimate of what one ablebodied man can accomplish in one day under average conditions is belyful, and is offered as follows

Fixen viction, pick and shovel 195 cu. It Hubbicorfieldstonemasonry 40 cu. ft. Concrete, hand mixed and placed , , , , , 54 cts. ft. . 10 sq. yds. Cellar floor, concrete Cutting blue- or limestone 7 sq. A. Bracks, common, B-m. walls with 850 bricks or 56 sq. ft. 425 " 28 " Face brock Concrete block, (Continued on page 137)

Useful Ideas for Your Car

Air Moistener, Battery Handle, and Other Ingenious Kinks

Fig. 1 Using

NLESS you are equipped with a special jark designed low enough so that it can be placed under the axie when a balloon tire goes flat, you may find it extremely difficult to change treet. If you get stuck this way, your space tire may solve the problem. Simply place it in front of the flat t re as shown in Fig. 1 grive the car ahead till the flat bre rolls on to the space, and then sho the

onch under the rear axle. Working the mack lever takes the weight off the spare tire so that it can be eschanged for the flat one.

Saving Your Springs

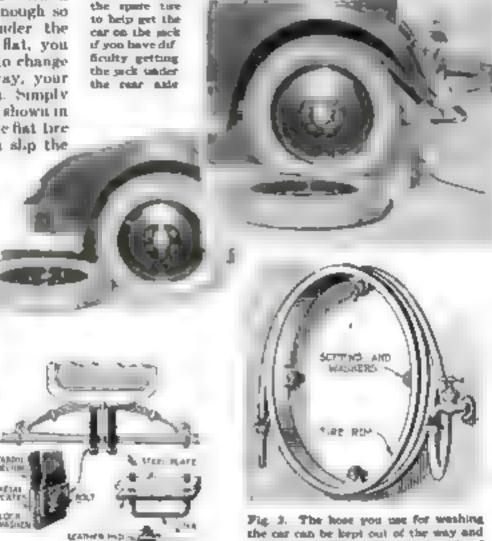
WHILE the best pos athle maurance ngainst spring breakage is a set of properly adjusted recoil anabbers, you will find that fabric belts clamped around the axle and the frame as shown in Fig. 4 are worth. while. The belts will not mterfere with the free action of the spring when a bump in encountered, but when the car starts to bounce too high. they will prevent beading the springs the wrong way so far that they break. If your ear bus a tendency to excessive on and down wobble when you hit a succession of bumps, special clamps, like spring chps, fitted with leather fretion pads, can be used to increase the friction between the leaves and in this manmer denden the spring action.

Old Rim As Hose Rack

HE short piece of hose that you keep in the garage to wash the car can be kept in good condition. handy and yet out of the way, by bolting an old rim to the wall near the water tap as shown in Fig. 3. Almost any old rim will provide ample space for the short piece of nose that as ordinarily used. in the home garage.

Simple Battery Handle

FIGURE 4 shows you how to make a simple buildle that will fit almost any storage battery. It is made from a stout piece of wood, such as an old shovel handle or fock handle, and the end links are from an old cross chain. After the holes are drilled at each end, two links are straightened out and passed through the hotes.



where it is heady with a real made of an old automobile rim at shown abuve

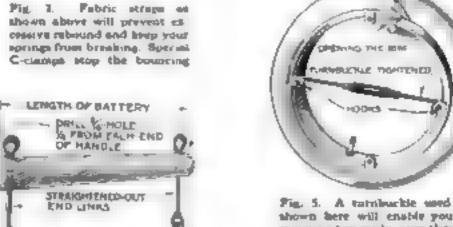


Fig. 5. A tutnbuckle word as shown here will enable you to remove a tire canly, even though it as hadly contact un to the rate



Turnbuckie Compresses Rim

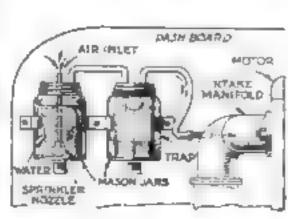
F YOUR car is fitted with rims on which the lugs are part of the rice, a good sused turnbuckle can be used to compress the rim and allow you to take off a tire even if it is builty rusted. Write it is better to use a large tarabuekle, a amali one will do if you piece out from the turnbuckle eves to the lugs by means of books of the proper length. Fig. 3 shows how the turnhuckle prused

To Close Platon Rings

TF YOU find it necessary to fit new staff rings and you bave no ring compressor & string arranged as shown in Fig. 6 will permit you to do the 10h without fromble. Tie. the end of the strang to any convenient bolt, pass it around the ring and pull on the hunder.

Air Molatener

NE of the objections to the oromary way of building a moistener for the air that goes into the minifold of your motor is that there is a chance, when the car goes over a bump, of the water's splashing up and being drawn into the marifold in the liquid state. By build ing your air moistener in two mason pare as shown in Fig. 7, the second jar acts as a water trap. In operation, the suction of the manifold causes a constant stream of air to flow from the nozze to the first per and come up through the water in the form of fine bubbles. The amount of water vapor absorbed by the air is in proportion to the size of the bubbles: the smaller the bubbles, the more nearly the oir drawn through the jar approaches the saturated state.



END LINKS

Fig 4. An old

shovel handle and

some end lanks from.

es old skid chain

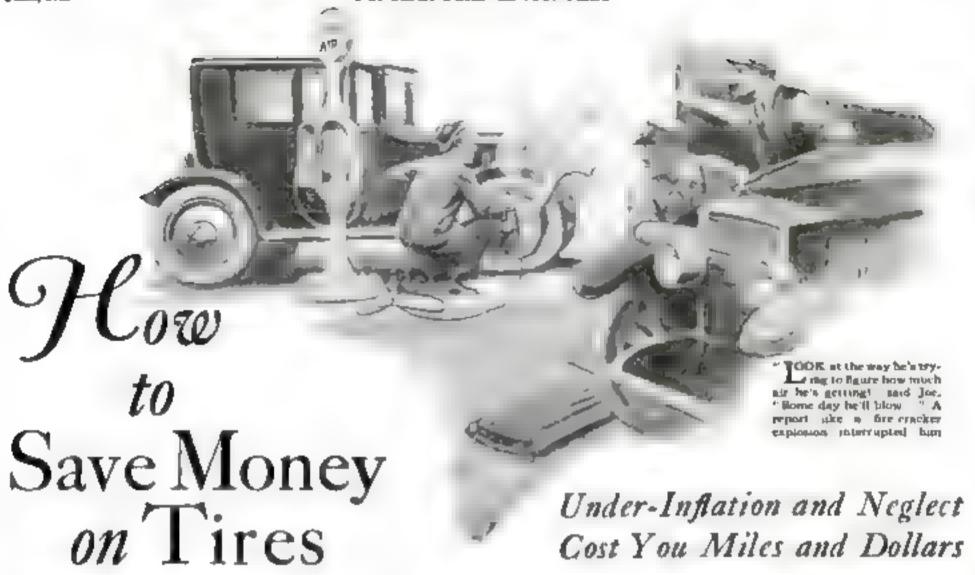
can be made into

the sturage hattery

bandle shows above

Fig. 7 Ingen-ONE BITTEDEC exect of two Marketon jates to ocree on an air moustener The second our preventuany of the water from being drawn into the cylinders

M. L. BURGHAM, of Parasseus, Pa., wins the \$10 prize this month for his suggestion of an air mosstener (Fig. 7). Each month POPULAR SCIENCE MONTHLY awards \$10 in addition to regular space rates to the reader sending in the best idea for motorests. Other published contributions will be paid for at usual rates.



LD BIRR sore has a permarient crimp in his pocketbook 'gramed for Clark to his partner, this Wilson as the r departing costonier let as the clotch and drave away from the Movel Garage.

"He's penny-was and pound-foolish." observed Gas. "Our prices on tires are remongable and we don't palm off stale stock. Just want till he gets stock good and plenty on a gyp' tire then well Lave han for a regular customer?

About a week later Burr paded up ex front of the Mouri Garage near the air pump and proceeded to apply the hose to his tree. There was a new slace on Lising it front wheel true noted.

"I ve trien to sell bim a t re pressi re gage," said Joe. "The old thebland with my one. Just look at the way lock trying to figure how much air he a getting? Kicking the tires won't ted hat anything, Someday hell blow ."

A report like a fire-cracker explosion interrupted in m. Burr in an instant was enveloped in a cloud of itesty the tale

"By Joks, he's gone and done at" The two men rus ied over to Burr, who was vamly trying to dig the dust out of his eyes. Apparently the tire had tors loose from the ron and the blow out had apped a five-inch piece out of the take. Both the new sloe and the tube were completely rained.

"TIL have the law on 'em for sell-I ing me a dangerous article blustered Burr when he had recovered from his amazement. "They guaranteed that tire, and I'll see that they make good "

" If you do." soothed Gus, "it will be the first time I ever heard of a gyp making good on anything. Besides, you can't prove you delu't blow it up too hard, working without a gage."

"But I can tell by kicking when

By MARTIN BUNN

they regetting enough air "protested the angry motorist. I never had any trouble like this before

Your for must be a lot more sensitive. than tome, then," growled Gas. He bent over to inspect the wrecked slote. "This stre is a gyp botoney for for Hardy any wires in the bead sno wonder it stretched over the edge of the rim. And look bow thin the rubber is."

"Humph" snapped Burr. "And how do you account for the fact that I got fore nuleage out of the last slace I borgat. from that same dealers

"Good back Duit wall "Gus mowered "You might have as good link again of you buy more of hos junk tures. But you can take it from me, when a man sells



What Was Wrong with Markin's Car?

IN THE February issue Powtan Science Montant published a story detailing Markin's troubles with his new cur, offering a prize of \$25 for the best fetter explaining the trouble and telling how to overcome it.

Julius C. Lapp, of Orano, Maine, wine the prize. The condenser was short-cuended, and many contestants indicated this as the source of trouble. Of these, Mr. lapp in the opinion of the judges, offered the most accurate diagnosis of the (couldo and the emplest and most effective remedy.

you a ties at half the regular price, it

isn't worth even that

"The worst of it is that it takes an expert to ted what's the ioniter with a cheap tire. It may loss all right, but bow do you know that it as those ered? Or purshe there was break in the curs Jahrsc under the rubber

IT'S all right to talk about 'factory bleggished trees and how there's notlong the mutter with toem except possably an 'trregularity in the trend' or that they 'don't look just right,' bit you can bet your boots the factory impectors aren't going to throw out a tice just because there's a couple of fly ones ks on it. The impectors are paid for known ig how to find real defects that will scorten the life of the tire, and when they say it a not up to soulf you can take if they re right,

Of course this tire wasn't even a good factory "second". It's just a jenk tree made to seh at any price and still give the denser a fag profit

Perhaps you're right, admitted Bure hill convinced in spite of Ligoest, How much did you say you'd charge me for a new shoc with a act of disepant for easily?

"I il threw in a really good tire gage as discount, ' granned Joe, " It'll save you more dollars than any cash discount."

"I'll take it," agreed Burr. "It seems like a lot of money to be spending on one tire. Thougo.

Not when you figure it out on a dollars per mile basis. That's all

you're getting out of any tire-so many nules of runaring at so many cents a nule, and if you can get twice as many miles out of a tire that costs only a quarter or a tland more, you re making a big saving. If some manufacturer could make tires that would give fifty thousand miles instead of the ten or fifteen you get now, they'd certainly be bargains at a handred dollars apiece

"There are other ways you can save money on tres, too." Gus added as he started mounting the new shoe on the rim, "Taking care of them is the best way I know of. First and most important, keep 'em pumped up to the right pressure all the time. Joe'll give you a chart that shows the right pressure. Keep the pressure two or three pounds more than the low limits shown in the table. Also, you want to remember that the weight the tires carry it what determines the amount of air you want in 'em. If you go on a long trip alone, you can get easiest riding

qualities by having the air pressure down pretty near the low bunt

N THE other hand. if you start out with four or five bug. lasky chaps in the car besides yourself, and a lot of lugginge for good measare, remember to pump the tires bard enough to take care of the extra weight. Three heavy men on the back seat and a trank stragged on herstell may add as much as three hundred possible spices to the load on each rear tire. and if the pressure is down to the minimum figured for the we gut of the curnione, the extra weight will anumate out the tires and the side walls will get too much bendag. That means destructive friction in the cord fahric in the sine walls of the tire, and if you happen to run over a car teack or a brick, you are almost sure to get what is known as a ritabruise. The tire may look all right for quite a while afterward, and then there'll be a mysterious blow out

"That explains what must have happened to a shoe that blew out last year," said Burz. "It looked like a defect to me, but now that I think of it, there was a slight deut in the rim at

that point."

"Sometimes you can dent a rim without damaging the tire," explained Gus, "but a dent in a rim is a bad sign. If you have tried to pound a dent out of a rim, you know how tough the steel is. It takes a thumping hard blow to put a deut in one. That blow is transmitted to the rim through the walls of the tire."

Then if I keep my tires pumped to the right pressure, my troubles will be

over?" questioned Burr

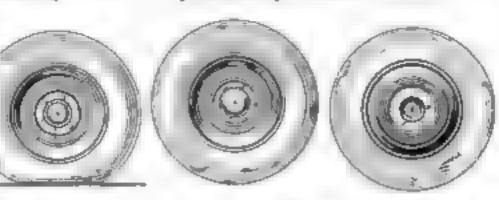
"MOST of them will be, but other little things can cause a lot of grief. A piece of glass in the road may make a cut in the rubber tread that looks too trifling to bother with. Water gets into the cord fabric through the hole and rots the cords. After a while the tire blows out at that point; or maybe sand works under the tread, raises a blister and eventually rums a part of the tread.

"Watch out that your tire chains aren't too tight, too. If you don't have them loose enough so that they can ever around the tire, they will cut right into the rubber."

"I don't use chains much anyway said Burr, "so that doesn't bother me But what am I supposed to do about those little cuts and thougs?"

"The sufest way is to go over your tires once a week," Gus advised "If you find small cuts in the tread, fill up the hole with tire dough, if a piece of the tread has been torn away, have it videnated before it gets any worse

"How many nules have you driven this



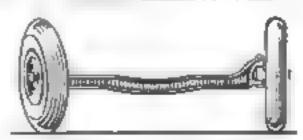
Under inflation causes excessive treed wear

Cuts in tires should be repaired at pace

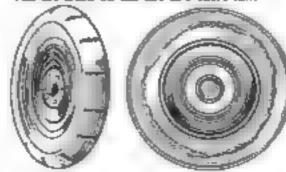
fined works under the trend, raining blutters

Use This Table When You Inflate Your Straight Side Balloon Tires

inda tota tota Pres	Maximum Land Corrying Copieties For Wheel (Car and Passengers)									
Sure (Libe.,	4.40	4.75	4.95	5.25	5.77	ı	6.00	6.20	6.75	7.30
22	500	SRO		700		ı	850	900		1150
24	550	635		760			975	980	1100	1260
26	500	890	725	430	880		1000	1060	1.700	1370
28	650	745	780		950		1075	1140	1300	1480
30	700	800	835	940	1020		1150	1220	1400	1590
35	750	855	890	1000	1090		1225	1300	1500	1700
34	900	910	945	1060	1160		1300	1380	1600	1810
36	850	,	1000	1120	1230		1375	1400	1700	1920
34			1055		1300		1450		1800	1
40			1100		1370	,			1900	
43					1440	ı				



Wheels that are even slightly out of line rub the trend off the tire is a short time



Cuts such so these are caused by tight chains

Scraping against curbs does this to your tires

other front tire?" Gus inquired, bending over to impect the tread.

"What's the matter with it?" countered Burr suspiciously. "It's nearly new. I put it on about a month ago." "I can tell that by looking at it," Gus laughed, "but I have a bunch that the wheels are out of line. The trend access to have a subbed appearance on sed by the adewise slip that always happens when the wheels aren't in bue. Have you bumped into anything latery?"

"CERTAINLY not" replied Burr That is, I haven't lot anything. About two weeks ago, though, I got into a pain and had to drive up over a high curbstone to save smadia g into a car. It jarred the car quite a bit."

"That's what's the matter, then," said Gos. "You must have hit the

curb at an angle and the sudden strain bent one of the steering knuckles a trifle. I'll line up the wheels for you right away. You want to watch out that the front wheels don't get any solewise bunqui bke that. Even running the front wheel against the curb when you re parking the car will sometimes spoil the alignment. Driving fast in deep rats is bad, too. Wheels that are out of line as much as a quarter or a half inchwill grand off the trend to no time.

"I should think that if the front wheels were out of abgainent you would notice it in the steering," observed Bure

"Not necessarly," Gus replied. "A slight error throws both wheels out a trifle, and the strain is divided between them. Besides that, the steering wheels on modern ears are genred so low to make easy steering with balloon tires that a slight drag would bardly be noticed. The only safe way is to have them checked up occasionally, especially when the front shoes seem to be

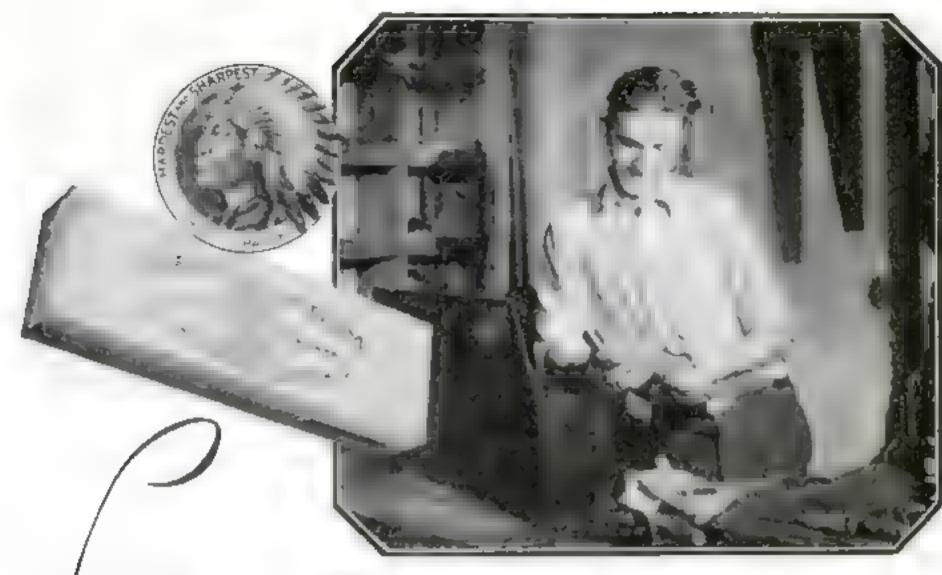
wearing more than they ought to.

"Here's another point that lots of drivers don't reasize. Extra wear 10 put on the tires if one of the wheels webbles because the axie is bent or because the rim isn't on straight. This accounts for many queer cases where the tread seems to wear away much more at two points on opposite sides of the tire, remaining unworn at the sections between. You see, each time the wheel turns, a part of the tire moves adecime as well as straight ahead, and that means exten friction."

"Well!" said Burr, "My peignbor's tires never seem to wear out, and now I think I know why! I notice be's always testing the pressure or looking them over. I thought that was all foolishness and a waste of time, but there may be some-

thing in it after all."

"Two things," Gus stated. "First, you save money because your tires actually give you more miles. Second, if you know at how you stand on the tire question, ou're not likely to get stock with a flat tire so often,"



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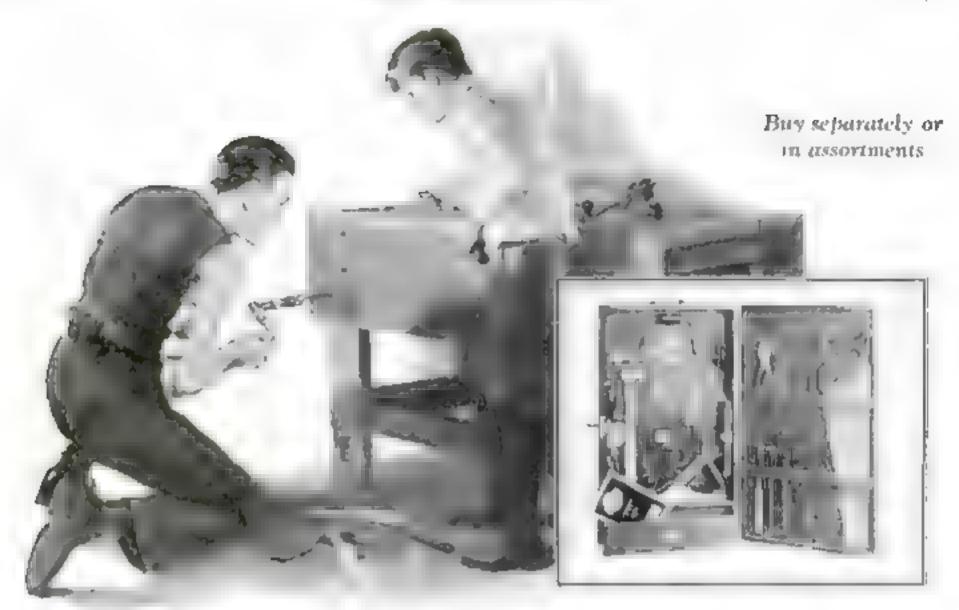
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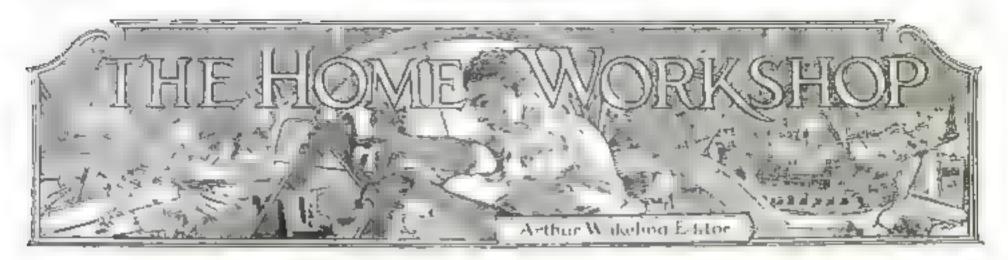


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The sides, top and ends can be transported easily by eac. The platform and fra nework are built on the spot and left

in place permanently.

One of the strong points of this arrangement is the doing away with the usual pegs for holding the tent top and fly. Every tent camper can remember the stormy nights when all hands have not to turn out in the midst of a violent downpour to drive down slipping tent pegs and adjust the shrunken guy ropes. In place of pegs, there are separate guy rails, each 2 by 2 in, by 15 ft., for the top of the tent and the fly. These are supported by 2 by 4 in, posts, heavily braced.

By HENRY S. LARABY

The method of building the platform and framework is made clear in the drawing at the bottom of page 106.

To set up a camp of this kind, first build the platform and frame and then use a steel tape to take the overall measurements of each section that is to be covered with canvas. Make sketches and put on the dimensions as you go along. This done, give the woodwork two coats of good outside oil paint.

The canvan sections can be ordered from a tent or awning concern, or one can sew them at home. In either case select a good grade of 12-conce canvas.

If you decide to make the sections yourself, find a floor or other cleared surface large enough to lay out the largest of them. Measure off a section and drive a 1½-in, and at each corner. Go 3 in, outside of these dimensions, and

drive other mills at the corners. Around the outside made atretch a cord tightly Lay the emovas in strips across the section in the proper direction, lapping them I in, over each other and pinning at intervals of 2 ft. When you have laid and panned a strip, cut the canvas off where it passes the cord. Leep laying and puraing the strips until the surface is covered, trun off the ends of the combined strips so that the edges are straig it. and then move the confibuck to the nails that mark the finished size of the section. Fold the edges of the section over twice, that is, make two 1-in. folds (see page 106). Pin the edge as you go along.

Corner pieces can now be inserted, if desired, lay them under the folded edges and pan in place. Fold up the pinned section when completed and lay out the next.

When all are done, sew them up with the heaviest thread the machine will handle, Windows (Continued in page 106)

A Table for Your Bench Lathe

How to Make a Neat and Convenient Stand for Small Machine Tools—Reduces Noise and Vibration

By COLIN L. BLAIR

IIEN the writer purchased a small screw cutting bench lathe, he was confronted with the problem of constructing a sat slactory table arranged for its motor drive.

The usual method of driving small in the secons to involve the use of an overlicud countershaft, and this was not desired. As the cutfit was intended to be used in a city apartment, compactness and next appearance were essential; it had to be quet in operation and all possible parts included. There was also required storage space for lathe attachments, band tools and miscellancous small supplies.

The table shown in the accompanying photographs and drawings was built to meet these conditions, and in several months' use has proved entirely

astisfactory.

The dimensions shown are suitable for a bench lathe taking work 14 in, long between centers, and driven by a one-quarter-horsepower motor of average rize. Needless to say, these dimensions must be checked for other installations.

THE table top is of sufficient size to accommodate also a principal head and a small drill press, which are mounted so as to be easily portable. These are not slown in the photographs.

Any suitable hardwood may be used for the construction. Oak is possibly the best. Yellow pine coats less and will be found a little easier to work; it is entirely autable. Be sure to get well-sensoned

lumber. The panels, doors and divisions in the locker space, and the drawers (except the fronts) pmy be of soft wood, such as white pine. The drawer holloms are of phywood, sign, thank.

The finish of the table is a matter of taste. The writer stained has with walnut oil stain and applied three coats of variash. The interior parts were given three coats of shellac.

If the dimensions shown do not



The framework for the bothe table is easy to amende, so the joints are drawn together with severe, after which the boile are plugged

meet your requirements, it will be necessary to prepare a dimensioned drawing. Then you may order the material from the not, funded four sides. Many of the pieces may be combined and ordered in long lengths. Be sure to allow for tenons and squaring up. The top, which is 1½ in thick, is allown in two pieces with a sphoe in the point.

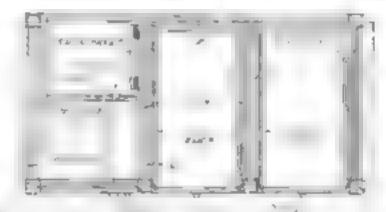
ALL the principal joints are mortised and tenoned, and fastened with No. 12 wood screws, 136 in, long. The screw holes are counterbored to receive the heads of the screws and filled with wood plugs. These joints are easier to make and stronger than convenied fastenings, and in an article of this nature it is immosterial whether or not the plugs show. On a painted job, of course, the plugs would not be seen.

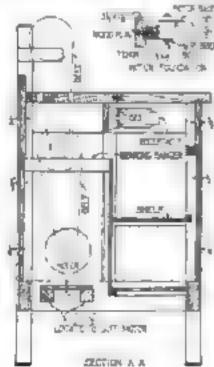
Because the left end of the bench is shown so clearly in a photograph on the opposite page, a sectional year through the locker and motor compartment is

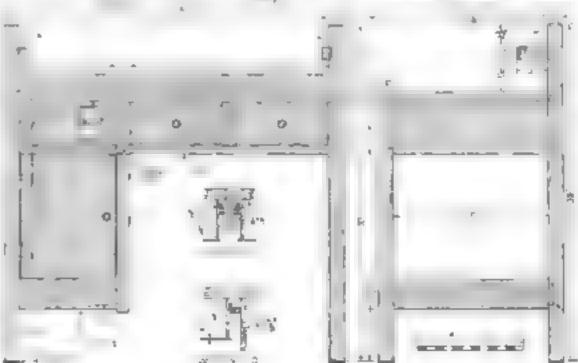
tired in the drawings below instead of a left-hand elevation. The left end is similar to the right except that the upper rad is 1½ by 3½ by 18½ m, and there

The last section of the la

r door It by I-Ps 12., if a server of the meter consists of the right-limits and the right-limits are limited.







Working drawings of the table and details of drawer runs and motor foundation. Note the method of wiring, the

convenient switch at the front of the bench for controlling the motor, and the provision for connecting a aght

may be laid out first and the tenons cut. Be sure all joints are square and each piece is of correct length. Then square up the legs and lay off and cut the mortises. Fit the tenons to their respective mortises and mark each for identification Locate the fastenings and hore 14-in, holes about 14 in their and their bore for the screws.

AFTER this part of the work is finished, it will be well to anadpaper all pieces. Assemble the two ends first, using a good give in all the joints. Draw up with the acrews and then wipe off the excess glue with a wet rag. The feart and back rails come next, then the motor compartment and foundation. After the fastenings are all set up, the holes may be plugged with 14-in, wood bungs.

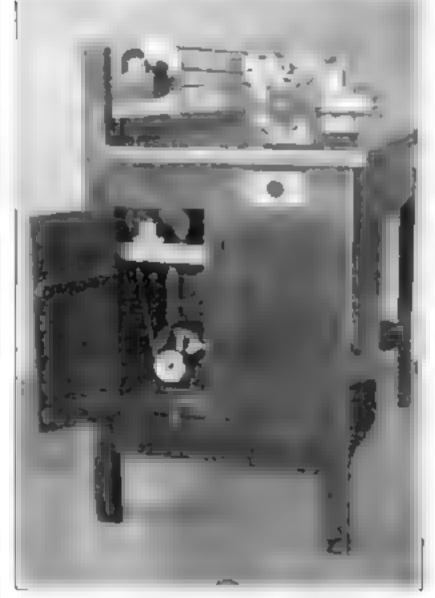
Now fit the hangers for the a termed are shalt bearngs and bore for the bearing bolts. Locate the motor and bore boles for the bolts.

Put in the panels and finish up the locker. Then fit a block for the fuse base. Make the drawers and fit the drawer slides. The doors

may be fitted and the larges located, but do not hang them until after finding.

Locate the receptacle and switch and fit them in place, also the fuse base and an outlet for the motor and another for the light. The scheme of wring is shown in one of the drawings. Notice that the switch controls the motor only the heavy stranded copper wire well assisted, and solder and tape all joints. The fuses are of ten amperes.

Now you are ready to fit the top, and if this is in one piece, so much the better. Counterpick for the acrews and drill the holes at a slight angle so as to draw the joints tight when the screws are driven up.



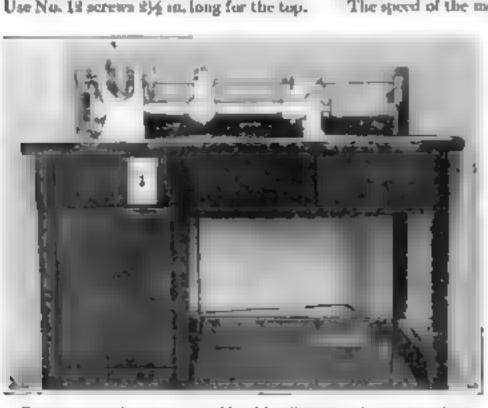
End view of completed table. The motor, shaft bearings, and lathe rase on him, thick rubber to do away with vibration

After planing and sanding the top smooth, fit the hangers for the counterstaft bear-

You can now locate the lathe and bore beles for fastening it. Locate and cut holes in the top for the belt to pass through. Fasten 14 in, thick rubber on the bottom end of each bench leg, and put 15 in, thick rubber under the motor, all bearings and the lathe. Sandpaper smooth and faush as desired: then hang the doors, put on the drawer pulls and the plates for the receptacle and switch.

The bearings, four in number are of the conventional pillow block type. In this justance they were made of Babbiti metal. The shafts are of steel. Fig. in in diameter. The speed of the motor is 1750 R.P.M.

It is fitted with a grooved \$16-in pulley. Two pulleyo ő in. in diameter and one g in, in dumeter grooved for a cound belt and bored for a 26-in. shaft, were bought and arranged as shown. The countershaft meed is 315 R.P.M. A cone pulley havmg the same danncters as the lathe cone was fitted on the countershuft, this arrangement gaves the lathe spandle speeds of 160, 315, and 570 R.P.M. without using the back gears.



Compartness and neatures are achieved by eliminating the usual overhead countershaft. There is some at the right end for a sould drill or grinder

A New Way to Hide Wallboard Joints

WHEN fiber wallboard is to be covered with wall paper or with the camby applied plantic paints that are now so popular, the average home worker is pizzled as to the best way to make sure the joints will not crack open in the course of time and disfigure the walls.

If panel strips are used to cover the joints, the shrinkage and expansion of the boards does not matter, but in cases where panel strips are not desirable, the problem of concealing the joints permanently is a difficult one.

What is claimed to be an effective method of treating joints was recently developed in the research department of the manufacturer of a thick type of fiber wall-board. The boards are nailed up in the usual way with 135-in, galvanized roofing nails having \$5-in, heads, spaced about \$10, along intermediate stocks.

After being amouthed with coarse sandpaper, the joints are painted with a gesso or putty mixture prepared in the propertions of 5 lbs. bulted whiting, 14 gai. hourd glue, 14 pt. oil paint of any light color, and 14 pt. linseed oil.

A step of common galvanued insect screening (wire cloth) is applied over the geno immediately and the paste is worked through and over the mesh with a few strokes of a trowel or painter's scraper. After the geno has been troweled amouthly off for it or 5 in, on each side, the extra thickness is hardly policeable.

At the corners of the room a 6-m strip of screening is bent to a right angle and similarly comented in place. All exposed nationals are pointed up with the geno. Then, before the wall is to be papered, a coat of paper hanger's size is applied.

A WALL prepared in this way is not of course, as smooth as plaster, therefore a heavy and rather rough paper with a bold figure is best

When plastic paint is to be used on the wall, the sterps of screening are fastened on with the paint itself. The paint is applied on top and pressed through the mesh with a painter's scraper. After the nails have been pointed up, the plastic paint may be spread over the entire surface.

How to use plastic paint was told in our January and April, 1927, issues.

Turning Wooden Segments

N TURNING a wooden article which is composed of two or more segments. it is difficult, if not impossible, to turn the piece first and afterward split it up. That is especially true if an odd number of segments are required and the object must still retain a perfect circular cross section. To overcome this difficulty. the pieces are made up with the correct center angle and then glued together with heavy paper, such as draftsman a detail paper, between each of the segments. After the whole is thoroughly dry, at may be turned and the segments separated. Gluing parts with paper between us indeed, a trick frequently used by cabinetnukers.



The Latest in Block Puzzles

For all members of the family-A novel, fascinating pastime

Certainly you ren solve it! This is at intriguing of block purales indeed, many puzzles or core-And there are more collection of emer toming block pussion, much molutions on our Blueseigt No. 65 there has on page 101.

entire outfit can be made in the course of an hour or so. The paper on the e-gar box should be accuped or sauspapered off The bottom (E) is 5 m. square. On this is glued a frame (D) of \leq_2 in, wide strips, making the inside measure of the box 4 in, square. On this is glied an open-end frame (C) of 14-in, strips if ish with the sides and one end of the box, Above this, also flush with the sides and end, or gloved another open-end frame (B) of \$2-in strips. This forms a box with a groove for a sliding cover (A) 4% by 414 in, on the end of which is glued a strip 15 by 4 sm. Instead of glue, the on is of the eight box may be used to finden the parts together.

The blocks for the puzzle must not fit tightly; they should be made so as to slide easily into the various positions.

THE constructor may make a more elaborate and finished box tonn this if he desires and it will be well worth the effort. The size of the pusale may be either larger or smaller. If something still more simple sidesired. The praxile may be call out. of cardboard. There should be a bottom with a *350 feature of the same eard. board given on to hold the pieces in position. The darker blocks may be blackened with a pened-

In der sing other forms (such as the SC post so shown in Fig. 4) for the second position, some may be found in which it is impose ble to move the blocks, The oblong piece is especially obstrate in blocking the way of progress, and for certion figures if may be necessary to saw

it into two pieces.

The solution of the PS puzzle will be published in the July lesure. It is also to be found on our Blueprint No. 65, now ready, which illustrates a number of other fascinating yet simple block

puzzies of various types. (See page 101.,

By ARTHUR L. SMITH

ZZLES of the flat moving block type, whick are now so popular, are always of alsorbing interest until sorved. The one here illustrates should retain its in erest longer than the ordinary. possies because it assumes the form of a Insentating game. After the solution of the problem as first suggested is usastered. the solver can devise other letter or geometrical forms into which the macks may be moved from the r Greek cross position (Fig. 2). Thus it becomes many pazzles in one and an endless source of

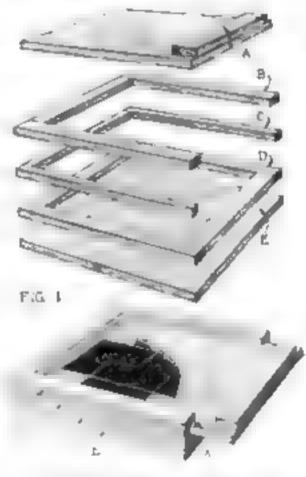
There are 11 blocks: 8 are 1 to, square & are Lossaped with 2 at urms one is oblong 1 by 2 m. The two I shaped blocks, the oblong one, and four of the I in, square blocks are preferably darker than the others. The blocks may be purited or stained, or two woods of different colors may be uses.

The blocks are placed in a box so that the ducker ones form a Greek cross and two of the lighter ones are removed as in Fig. 4. These two blocks are metely to prevent disarrangement of the others when the puzzle is put away

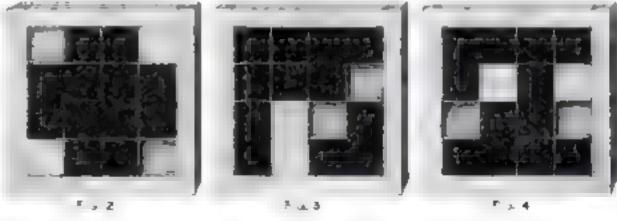
THE problem is to move the blocks from the first position to form the letters "PS" (POPULAM SCIENCE) as grown in Fig. 3. The blacks are not to be lifted out or twisted around, and the box as not to be reversed.

Those who find the puzzle easy to solve in this form, will find it more difficult to work it backward, from the PS position to the Greek cross.

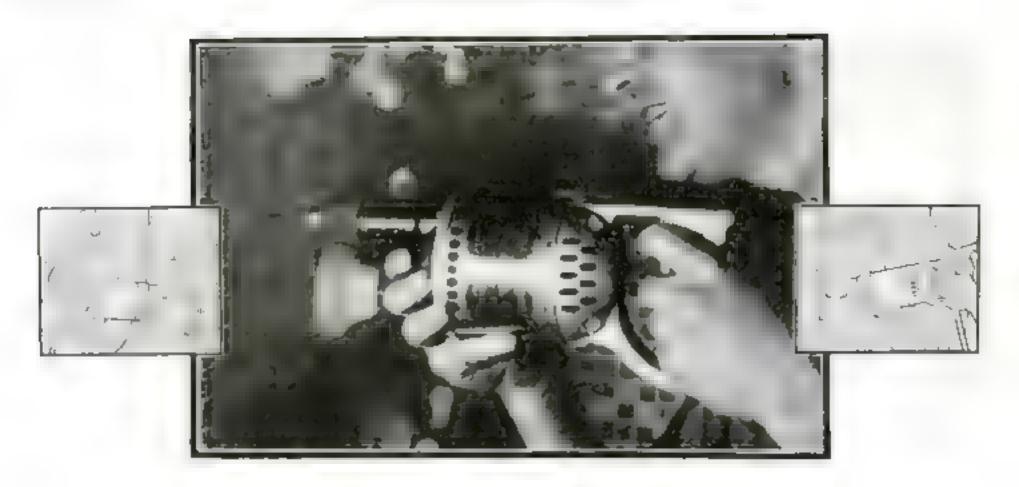
A sample method of making a box with a slating cover for this puzzle is illustrated in Fig. 1. With a sharp kinde or a fine saw and an empty eigar box or two, the



An expectally easy way to make a near box for the puzzle. Cigar box wood may be used



The blocks are arranged first to form a Oceek cross (Fig. 2) and are moved by stiding them. from place to place to form a shape similar to the letters PS (Fig. 3) or the letters S C (Fig. 4



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crently ventilated . Protail brushes (not nonally found in drills of this size), early replaced from outside without taking tool apart . Gream lubelication throughout . B feet best quality subber covered and furnished . Spindin offset for close boring ... "an, from outside of bousing . Weight 3", this, not . Overall length 12 in. . Packed one in a heavy corrugated box . PRICE . to Valte, \$30.00.

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New Fishing Rods for Old

How to Repair, Rewind and Refinish Split Bamboo

By ROBERT PAGE LINCOLN

RILY can it be said that a habing rod is an good as the care you have given it. Even a cheap machine-made basi hoo rod, if kept in good repair, will be equal eventually to a high priced rod that has been neglected.

A rod may be in a good, indifferent or but condition when you go about repairing it. Often when it sotherwise in satisfactory could ton the tips of the rod will have sequired a " will or downward bend and they must be

made dragat.

Varnishing, at the very leas be an annual practice. It does not

need more than one worn ps ch on the rod to my te disaster. Moisture will get in and part the strips of which the rod is made. Then, perhaps in the midst of a struggle with a choice fish, the rod will Marij I.

If a root to in good condition suve for the vicenote, the original windings can be left on. If the windanga are worn, it is heat to take them off and scrape

the rod.

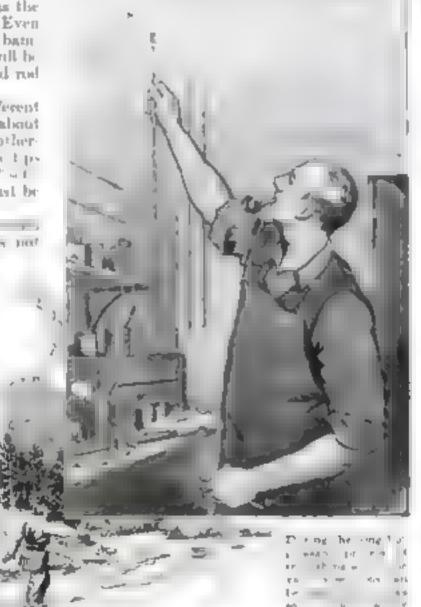
Old rods are apt to have strips ungleed up and down from the ferrules for perhaps 4 pt. After removing the ferriles, as allown in one of the allustrations on this page, spread the

atrips and re-glue with a rod-maker's give, which can be obtained at a most ary sporting goods store. Wind the whole length of the newly ghied section with fish me and allow to dry for a week or

two before semping.

Let us use for example a red that is in an indifferent condition, with worn patenes, imyed wondings and a set to the tips. Incidentally, there is no need of your tips becoming set. Even though every rod is supplied with an extra tip. many fishermen will use one tip continually, with the inevitable result that the strain breaks it down. Every fisherioun should have two extra tipa for his fly rod hearle . I ie one on the rod. One tip is used one day, the second the next day, and the remaining tip the third day.

ONE should never leave the jointed red hang og on hads along the walls of a cua n or cottage, as the tip will beist down. The rod, therefore, should always be taken down at might and carefully wiped dry. In the case of a bamboo bait rod, tie a weight (not too heavy) at the handle, fasten a cord to the tiptop guide, and hang it to a hook in the ceiling. In this mainer you can protect the tip piece from taking on any set. Even a best rod should have at least one extra tip.





Knd windings generally are started on the butt section right with several broad bands placed just above the bandgrap

a sufe way to loosen the apperment or typicop guide

No tip can be materially strengthened without removing the windings and the goldes. Having done this, take the tip in hand and easily and gradually work the bow out of it by bending it the other way. Pass it occasionally close to some pull source of heat to soften it a trife, too much heat will be rumons. The tip then in suspended from the ceiling with a weight hed to the lower end and left for a week or two.

The guiden are reinstalled directly opposite their former positions so that their pull will be against the previous

Ordinardy the windings in between the guides on a fly-rod tip are parrow no more than five or six turns of silk thread. In revinua, a tap strength is gamed by moreasing the welth of these barrier to about ten trens. How to make the windings will be explained in detail a little later on.

WHEN the tip so variabled and bend it downward a little at a time by working the t p alone. Then use the full-length play of the rod, with the bee threaded through the guides and tied to some stationary object. This is to get the tip limbered up.

If your rod is to be completely rewound and refinehed, the old varnish most be removed. A safety razor blade is a good tool for U.S. Carefully ent through the alk windings and strip them of their scrape the varish.

Never go deeper than the varmsh, since the hard ofter skin of the balabon is da strength and up at ust be burmed

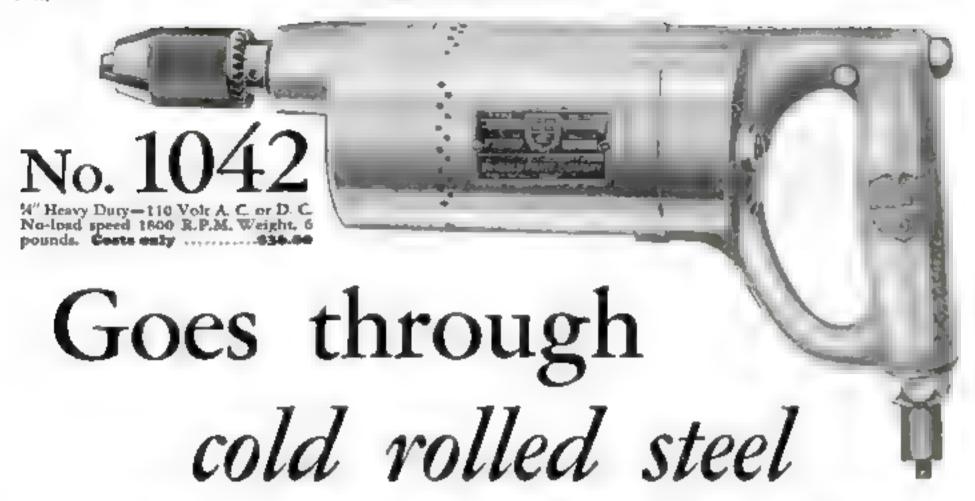
Be sure to make a pre momary drawing of each red joint to show where every guide and waisling good and make a pin prick on the rod itself at the exact center of each eye.

Care should be observed in removing the ferrules and the tiptop gorde, if, indeed, they must be removed. Heat the ferrule over a match flame or, better, beat an propered hot and turn the ferrole around on the root. The flame of a match is especially likely to injure the bambon close to the alcove of the toptop guide, and the bot ron method is safer.

To cement the ferrule on again, heat

the wood over which the ferrule goes with a match or over a fire and heat the fermie also. Me t the ferrule cement. which comes in slick form, on to the wood with a match and sip the heated ferrale home with a quarter twist. To return to the variable

ing operations, go over the scraped rod with the fluest grained sandpaper to be (Continued on page 92) had.



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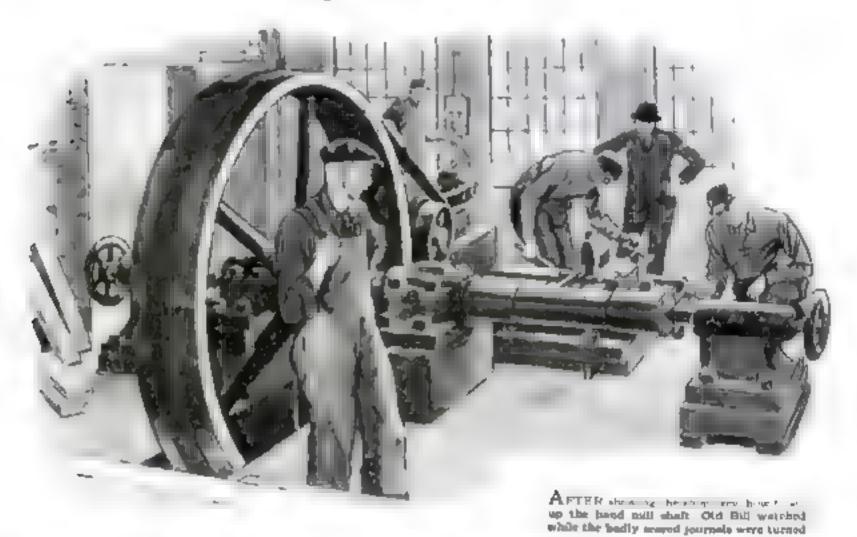
1500 GOOD TOOLS



A Job Too Big for a Lathe

Yet Old Bill Had to Turn the Mill Shaft Quickly How He Did It May Help You Solve Similar Problems

By JAMES ELLIS



LD BILL went to meet the office man who was harrying through the ship toward him. "What naw" he asked

The Bukiers want vin to come out to their saw in II as soon as you can The shaft on the band only is secred backy because it ran list and they can t get the wheel off so they can send the shaft to the shop

Old Bal knew the concern. A large establishment with a shop of its own it sent only the more lithicalt jobs to bim. He knew that the problem must be a real one if it stumped the Binklers' capable shop crew, so be prepared to drive to the plant, which was ten miles out of them.

He had plenty of opportunity to muse about things in general as he drawe for there was little traffic on the road, and the spring air made motoring pleasant. All too soon he was at the unit

This wheel is supposed to come off the shaft easily the mill foreman explanted, "but we have tried it with a twenty five ton jack, and can't do a thing with it. We wanted to know if you could arrange to turn the shaft without taking off the wheel."

Old Bill studied the wheel, Eight feet in diameter, and about four tons! Net a lathe within 200 onless that would swing it! Not even the wheel lathe in the milroud shop, for the shaft was too long.

Old Bill pondered these facts, and then started for an apparently angless walk. The mill foreman followed and Old Bill answered categorically the questions put to him. "Yes" or "no" was the only response he gave, for he was thinking. Finally he said. "We can form the shaft here as well as any other place.

The mill foreman and the shop's much nist Edward Lamons, looked at him blankly

"What! Why, we have no lathe that will take anything nearly as large as that" the mild foreman exclaimed, somewhat brateoly. "The largest lathe we have is only twenty-eight menes, and the other is only twenty."

The foreman's foot and on page 11.,

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, to be found on pages 169 to 118.



720



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last blade in the stropper now and expect to me it for some time to come. I shave every morning and the old "brutles" nee so tough seamy of 'cus." (Signed)



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Stroppers

How to Replace an Old Electric Light Bracket with a Sconce

By GEORGE A. WILLOUGHBY

RTISTIC A electric wall sconces can casely be installed in place of old-fashoped brackets which have be come defective, shabby or otherwose massistable.

The first step before starting this or any other type of repair or replacement work is to open the main house switch, Then to remove the old bracket (Fig. 3), loosen the acrew holding the canopy, and pull the canopy from the wall to expose the fixture support and the conner-

tions. Cut the fixture wires and unscrew the bracket, or, if necessary, first remove the screws holding the craw-foot or fixture stud and cut the fixture wires after the fixture has been pulled from the wal-

The next step is to provide a good support for the new aconce. The amplest way is to install the special stud furnished with the sconce by attaching it to the walwith three wood screws as in Fig. 2. but this is not necessarily the best. In some old installations where the crow-foot is attached to lath, it is a great improvement to substitute a suitable outlet buy (Fig. 4) such as now is used in good installations. It provides a fireproof melosure for the wires and a more right support for the fixture.

Select a aballow box which when at tarbed to the lath, will be thish with the plaster or extend slightly in front of it It must be provided with knock-outs for loom so the loom-covered wires can be brought into the box and clamped in place, as sinstrated. The fixture stud-



Fig. I ft is a simple Conter to substitute on artistic scence for an old-fashioned bracket

may be attached to the box with stove bolts or it may be screwed to the lath through openings in the Addational screw holes in the tion make a rigid installation possible. Hold the box on the wall where It is to be installed and carefully out around it with a smad, sharp serew driver or kinfe so the parater can be removed from the space within the circle. After the plaster has been removed, bring the loom-covered wires into the box and attach the box agrarely

The stud furnished with the seconce is threaded to fit a fixt ire stud, or it may be used in place of a fixture stud.

After the fixture support has been provided, remove covering from the ends and clean the wires for making the conbections. The joints about or made as

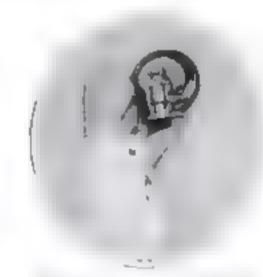


Fig. 3. The first step in removing the old farture or to loosen the canopy

illustrated in Fig. 4 and soldered and served with rubber tape on apheing compounds, and a serving of friction tape, would in the opposite direction. Then attach the sconce Fig. 1

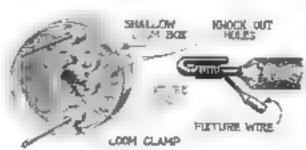
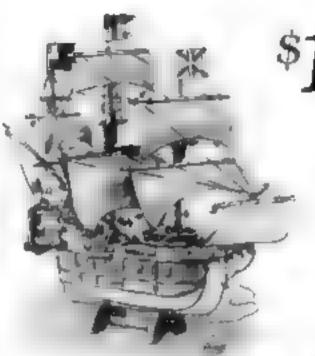


Fig. 4. An excellent type of outlet box for this work method of connecting wires



Fig. 2. Screwing to the wall the special stud fortished with the orw senace

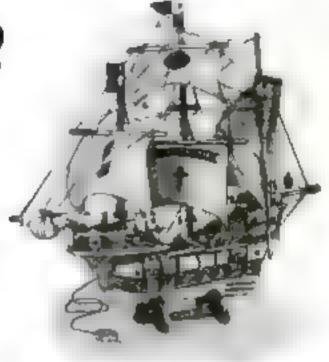
THE MELODY SHIP



\$12.50







SANTA MARIA, 1492 The Flagship of Columbus

Build a Ship Model Loudspeaker

Beautiful Tone Plenty of Volume No Distortion

Do you want a loudspeaker that is different? Do you want a beautiful Ship blodel?

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Of employing do All of those are to be toused to the MELOUP SHIP and it will not cost a so no reach for by hcombosed is one as the ordinary Ship Model or the schitchty bodspeaker alone would east. The SHIP VI-11 | when complete is the must beaut for date a union the market today. The analogometer equilibrium provides beauty of tone and guide-torted column that brings out the her master, reproducing the soom of the base you, drums and tuba, as we as the suprano tunes of tinks and flate. There is nothing like I on the market anywhere today. It is aboucute's new. This is not an especiment, but a real princes. device, sold on money-back guarantee to assure satisfaction. THE WORLD'S LARGEST BUILDING OF SHIP MODELS was supply you with party to build a MELODY SHIP You may choose either the Santa Maria or the Mar-Bower Model. The party for the Shap Models are made of word. The te bot a cheap rardboard mitation, but a real Ship Model. Patt on it together a new mode so & B.C. The instructions read a ke this . Put No. 10 on top of No. 48, and top aghtly with a small hammer of the Airchine bey can put one together in a few hours.

The Loudspeaker Unit is of the Florito-Magnet type. Power amphibitation is not needed to force the low transp through. They come through with east and do not interfere with the higher notes, giving you faithful reproduction at all frequencies. The Unit is placed in the main mast, which is firmly sented two nelses deep in the three-and-one-half pound hull making a myemoble for countermitation to affect the reproduction of the MELODY SAIL. The devicer pin in attacked to our specially prepared, raper subrating MLLODY SAIL It does not change the appearance of the Ship Model. Jastractions for shetsif hy come with such MELODY SHIP

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If you could a Philip Model and work to another the Mr. 190Y. Sale and that forward peans of ne drawing of your made ad We welther sent you'r VI had t will and turn the y sait Model, via Parcel Part C to D. 39 00 prus postuge

The unassembled parts for either the Santa Maria or Mayflower Model, a thout the Maist IV Still at adjacent on be had for \$4.90 proc postage. Ent. detailed diagram and instruction sheet dowing any endouging every operation for completing the Model supplied with each

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GUARANTEE R. after assembling the MILODY 199 P. you do not think it worth many Lines be purchase price In rotal condition and we will pludly be-What can be far er han third

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tode per un toposer per appep i silvante ber bestemm (pe juggen, eq buter bins best proposer per appep i silvante ber 10 so mer test. 10 bit Please estad me "be complete parta mil to an aist resil

MELODY WHIP MODEL SHIP MODEL and WILLIAM BATE for

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Ose sare to indicate whether you wan. Sabla blarin or hisyfaster. Musici

PLEASE PRINT NAME AND AL DRESS PLAINLY TO AVOID 10 LAY

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STREET OF R F D

Our or Years.

Medical

C This seal on a radio, tool or oil hurner advertisement algorities the approval of the INSTITUTE OF STANDARDS. See page 6.

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Over a period of years, we have brand of many ways in which pipe-smokers prove their devotion to their Involve tobacco

But the modal certainly goes to Joseph P Fink of Darby Pa

His letter follows

Darley Pa-Autofalan

Lagrange de la la dis-It thin obey Ya Centlemen.

I take he he to dweltings one company of the property of the party of the great

I have a masser for a swifting for sur-Intention of special content on the Armin Charter of William Lock and Science is Intelligente William Colored public content on the Little Content will be sent to the sent of the light managers of all members on be at three ments grouping as on as the a fe-fluoring his wind as excepted graphing stating

The root appropriate when the Armed Story Armed The entropy of the infinite that a finite is the entropy of the en Union daying the eye ement at the tele-

It is apport what a man which when his Insurite tabuers is concerned. I centure that without my tobacco it would be ebook on he og look op the spits of L a new need benefit

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On your radio time in the RF 4, Richmond, Fa. Like Edgeworth Station. Wave length 256 meters.

A Circular Saw Attachment for Your Tool Grinder

By EDWARD THATCHER

FOR the home shop not fitted with a power driven mw, the hand operated rereular saw illustrated will be found most handy. The whole cost of the one shown was \$3.86, which included the grinder and two circular saws, one for rapping and the other for crosscutting. If you have a

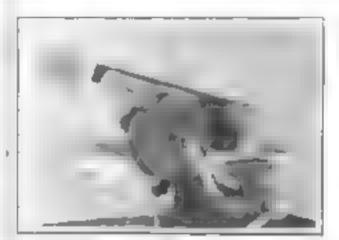


Fig. 1. Hand driven new for cutting and grooving ship model parts and small work

grander, the only expense will be for the saws. The remainder of the materials usually can be found about the alop.

While this little saw table is not for handling the beavier sort of work out with a power asw, it is most useful for the smaller pieces of wood such as are used by ship model builders, toy makers and those interested in the lighter form of construction (Fog. 4)

It is eather difficult to rip narrow steps

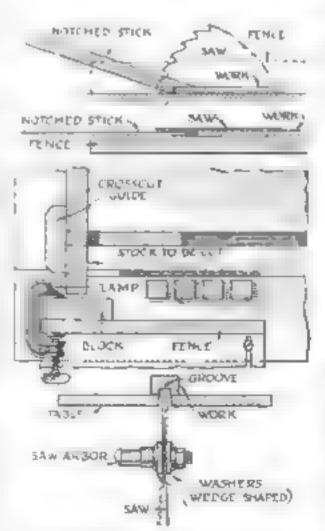


Fig. 3. How to rip narrow strips, cut off small blocks, and do grooving with a new

of thin wood with any degree of accuracy by hand, but with this machine any wood up to 14 in, thick can be cut into tanform strips; grooves may be made with and across the grain; and soft wood up to 1 in. thick may be crosscut, if the saw is well abarpened and set,

By making a special washer (Fig. 8) to cause the saw to wabble, it is possible to cut grooves 14 in, wide. Indeed, if you lave no other device for groaving, you will find it worth while to make the attach-

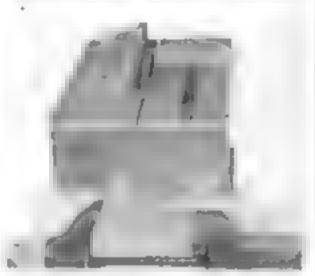


Fig. 2. The new from the year abowing crosscut guide and adjustable ripping once

ment for this operation alone. It will allow all sorts of small picture frame moldmgs and the like to be made.

In this instance the tool grander had a 6 in. wheel, so 6-in, saws were ordered, with holes to fit the grander spinitle,

The saw table must correspond to the sue of the grander. In this case the baseboard was cut 14 by 0 by 12 m, and onder it was screwed a piece 1/4 by 31/4 by 15 m., for the vise jaws to grip.

The table, which may be made of pine, whitewood or maple, io 34 by 8 34 by 13 in. It is really in two pieces, divided by the anw, as shown in Fig. 9. One piece is provided with a shallow groove for the longer of the crossent guide, which slides back and forth in it. This guide is a block of wood screwed to a length of candigon by as write and 5 to long, Several screw boles may be provided in the game so that it may be set for matering or at any angles. you wish. The slot may be lubricated by a blong a large lead pencil back and forth

The ripping fence is attached to the other aide of the table by means of wood arrews or stove bolts. Siols are provided so that it may be set at various distances. from the saw. Both pieces of which the gunde is made are by in, thack one is 14. by 9 m. and the other, 1 by 9 m.

The end of the table is screwed to a block I by 3 by \$1% in., or whatever the width of the table happens to be. This block is lunged to the base, as in Fig. 2.

Mount the grinder with the saw in place before hinging (Continued on page 87,

Circular Saw Attachment

(Continued from page 86)

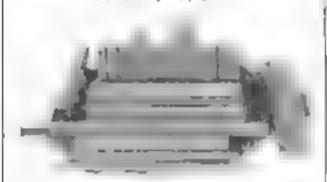


Fig. 4. This is the sart of work the saw does. Mr. Thatcher who is a distinguished craftsman, devised the machine to no emergency when he was temporarily deprived of power in his own very completely equipped shop. He found it so useful that he beeps it handy for small model-making and similar jobs

the table and make acre that the top is square or at right angles to the saw blade. and also that the slot for the saw rots namule, to the blade so that all work will be true and aquare. The table may be tilted and held at any desired angle by the grander tool rest, as in Fig. 1. That allows the depth of the axw cut to be varied for greetving.

The slot for the crosscut goods may be made on the saw stself, provided an extra piece of wood is used temporarily on the left aide of the table. Two cuts should be mude and the wood removed with a chosel

The naw should be turned up to fold apped before wood in fed against it and the same precautions should be used as with any circular saw. A notebed stick should be used to feed marrow strips between the saw and the rooms guide (Fig. 3). When a number of abort lengths of word are to be ent off a block should be clamped to the ripping gode and the work held at right angles to the saw with the crosscutguide, as shown in Fig. 8. Thus will prevent the pieces from becoming jammed between the saw and the fence, as woold he apt to happen if the block were not Court

The walthle saw (Fig. 3) merely requires a wooden or Babbitt metal washer thick enough to be cut diagonally into two parts, so as to throw the saw out of line sufficiently to cut the width of the required groove

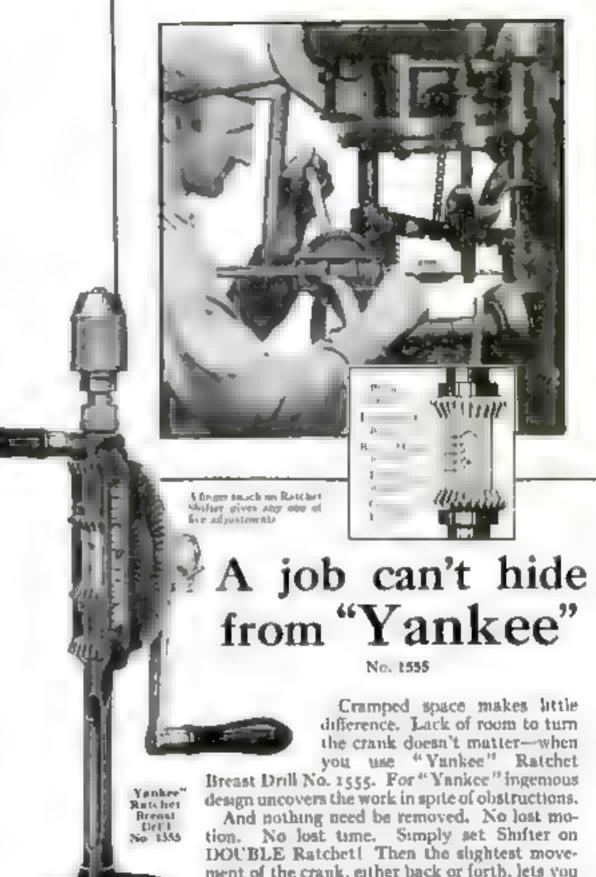
A saw table of this kind may be adapted. easily to a lathe. In that case the saw is held on a mandrel and the baseboard of the saw table is clamped to the lathe bed. at itable grooves or cleats being provided to hold it in line.

How to Hold a Spokeshave Blade for Sharpening

WHEN sharpspokeshave blade. there is some danger of granding one a fingers unless some sort of a border is used. A safe and easy way to hold the blade is with a small hand screw. -H. A. MELROSE.



Spokeshave blade held safely for grinding



ment of the crank, either back or forth, lets you drill continuously

The four other ratchet adjustments shown above, and two speeds, make this "Yankee" Drill the handlest and fastest ever designed. You can change speeds instantly without removing drill from work. Just shift lever at base of hub.

Ratchet Breast Drill No. 1555 (Illustrated), 3-jaw; No. 555, 2-jaw. Hold 3/2 in. Drills. Ratchet Hand Drill No. 1545, 3-jaw, No. 545, 2-jaw. Hold 34 in. For smaller drilling jobs use "Yankee" Ratchet

Hand Drill No. 1530, with five fatchet adjustments.

Some Other "Yankee" Tools

, Ratchet Bit Brutat. Serial Screw dr Automatic Feed Beach Drills

Automatic Push Drills Place of the Resches

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Tool Book

what you want to know

1 NNEF Tool for

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This interesting little book for a limers of fire Fools It to is sust

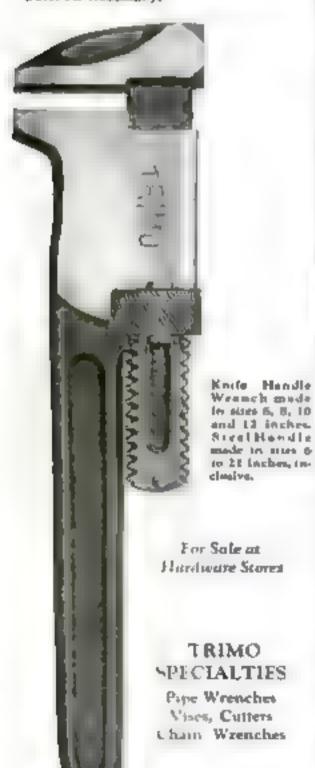
TRIMO

Monkey Wrench

Thousands of men bear with all their strength on the handles of TRIMO Monkey Wrenches, confident that a TRIMO will not let go.

It's a regular he-wrench-strong, rugged and enduring.

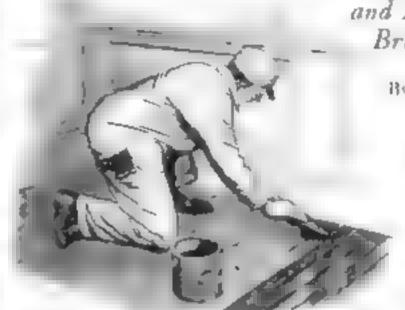
There's more than brute strength to recommend TRIMO Monkey Wrenches, however, for their jaws are skillfully designed to REMAIN PARALLEL up to the far distant day that old age makes a new and younger TRIMO necessary.



TRIMONT MFG. CO. ROXBURY (BOSTON), MASS.

America's Leading Wrench Makers for Newsly Forty Years

You Can Trust A How to Refinish Your Floors



Charle yerrunit steet procure on old floor

OW shall I finish the floors of my home? Which is better, shellac or varnush? Are brushing lacquers perviceable for floors?

These and similar questions are asked endlessly in every paint store. Let us, therefore, review the various finishes. It is taken for granted, of course, that the floor to be finished has already been sandpapered and filled properly, as outlined in last mouth a article.

The first finish to consider is shelling and war. This makes a beautiful finish when properly cared for but does require constant looking after to keep it in firstclass condition.

The shellac sold in paint stores should be reduced with three pints of alcohol to a quart of stock shellac. Orange shellac is preferred by some to white. It should be applied with an extra long black China. bristle brush about S or 4 in. wide.

Considerable care and skill are necessary in using shellar. Apply it quickly and evenly with a well filled brush to not more than three or lour boards at a time. starting in a far corner of the room. The strokes should be quark, even, and as few ga possible, in order to avoid laps.

All work should progress from the raw boards to the finished portions in order that the stroke may be lifted up quickly at the end of the left-to-right movement. in no case should the new stroke be started on the end of the portion last finished, or heavy laps will be sure to show. By taking care and studying the results of your brushwork, your skall necessarily will increase. The most common fault is that of over brushing.

Do not appay more than two coats of shedge in an eight hour day. The final roat should dry oversight so that waxing can be started the next morning.

Lather the liquid or solid floor waxes can be applied and on dark floors a dark or black wax only should be used or a gray east is apt to appear. To color floor wax add one part dry pigment colors to four or five parts wax by volume. Powdered raw siema, burnt umber and rose lake are suitable colors and these can be Shellac and Wax-Clear and Dark Varnishes-Brushing Lacquer

Be RALPH G. WARING

moved with wax to match any dark florar

V large bull of wax can be inclosed in casth and raphed on the floor. Cover the entire floor before beginning to polish. This may be done either with a weighted brush made for this work or with an electhe polishing brush, rented from the local hardware store. This last is, of course, a great labor saver, it prodoes a fine poush and pr

more than worth the rental charge. On new work it will pay to amply two conts of wax, allowing about an linur hetween coats to be sure the first has bard-

ened well.

I have found that a final rub either by hand or by facing the weighted brush with a more of good body Brussels carpet. will give an extra brilliant fluish.

Worn spots near the doors and on stair. trends should be washed with gusoline. dried and rewaxed frequently. All exposed portions of the floor should be waxed once a month, and occasionady polished with a weighted brush.

The pext type is the variashed floor Here again we have a choice between the clear variesh, which will not affect the color of our floor as left by the filler; the dark oak varoish starn, which is pure brown; the wall at stall which is one part red and two parts brown, and the dark mahogany varuuh stam, which is equal parts of red and brown with the red tone dominant. These transparent color variashes aid materially in producrag an even tone. They also have a material darkening effect on the whole floor. In general the varmed stain coat should be followed by a coat of clear varuesh

LTHOUGH it is often claimed that A varnish will dry hard in forty-eight bours, it is necessary that as much more time he given between conta na possible. Three days is not too much and at least a week should pass before furniture and rugs are pasced.

Of late years it has been possible to obtain a dall floor variish of light color, this gives a finish without high gloss as d similar in effect to a gloss varnish which has been laboriously rubbed dull with

fest pursee store and erude o l.

Contrasted with these finishes, we have the remarkable new finish called brushow lacquer. Here at last is a tough, durable finish that can be applied and used in a few hours rather than days or even weeks It does have its limitations, however, and is far from being footproof." On a newly thousand on page 80, sanded floor,

How to Refinish Floors

Continued from page SS

properly filled and hardened for fortyeight hours, clear brushing lacquer, of a quality guaranteed by the manufacturer. for this use, can be applied directly to the filler with a black Chana bristle brush with extra long bristles, made especially for larquees. If this type cannot be obtained, a fitch or on hair bristle brush is to be preformed a fairly soft sat full chasel or ish is necessary

The name of the trees class in that this kind of lacquer will ary in thirty minutes but after testing eleven brands. I have found none It at was not somewhat stake or tacky at the end of an hour. A floor is a ways so much correction the usual test panel used in the laboratory that both the turnal set and hardening are much retarded. For this reason I seriously object to the application of more than three coats of lacquer in an eight-hour day. The last cont should dry overnight with heat in the rosu t

TO MANY the odor of brushing his quer will be rather trying, but with free year latera the adapt will be dispersed rapidly and soon torgotten. One cantion should be observed and that is to avoid lacquerrig a floor in a room contairing a stove with a fire. I have held a lighted match I in from a panel inequered five minutes previously without having a thash, but the solvent and mr do form an explosive mixture, and because of this reasonable cure should be exercised.

My experience and been that floors cleaned with variash reneaser cannot be lacquered successfuly. On a test floor I treated one half with courts and the other had with variash removes. When lacquered the caustic treated section lundened at time. Feely five minutes tieother cleaned with various reprover those twelve tays to barrier I found upon t element examination that enough paraf-Bis wax remained on the floor arel as the talk to spote of careful cleaning with denot red dealed to consect respic with have a Marite traces of greats or way will so slow up the action of an ear that it is no better than varies, for speed. As a matter of fact, varueb applied to a dried

Hour previously elemed with remover will

try to a satisfactory finish on time

WHERE the punted floor effect is deared, especially in kitchens these bequee enomels—or pigmented facquers, more correctly speaking offer a genuine relief to the housewife whose family cares prevent the use of varue-oor floor chamels because of the "tying up of the kitchen. If the floor is well mopped n in which og soda and water at seven in the evening and denoting once at can be given a lost of gray floor lacquer for me slance in an hour allowed to dry overnight and safely used the next morning

Brushes used in accounts must be thereongly cleaned in larguer thinner or they

will become ruck hard.

Wax should not be used on lacquered floors, since so method I have yet tried will remove it so thoroughly as to allow the floor to be reinconered without slow 100 1 10



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To correct the mistakes of old-type shaving preparations for you - now please accept a 10-day tube of Palmolive Shaving Cream to try

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Palmolive Shaving Cream is a truly unique creation

We made it up to meet the supreme devices of 1000 men whose ideals of a shaving cream we asked

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Millions of men have flocked to it We think you will find it superlative to a shaving cream. Hence, seek the opportunity of sending you a to-day tube to try

These 5 advantages

- Mult plies itself in lather 250
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- 1. Maintains its creamy fullness for 10 minutes on the face
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Your present method may suit you well. But still there may be a better one. This test may mean much to you in comfort Send the coupon before you forget

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10 SHAVES FREE and a can of Palmolive After

Shaving Tale

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and the best of the seather in course we have reced-Z Tie wer I in the standard and a de to the w tion of force stands and та в Торовителя до одности В воз Интерести Форманская Соловия дени имперен Сурмуна уче



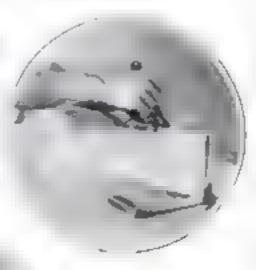
Neat Bookcase Joints

How to fasten furniture cases together without using nails or sereses-Dovetail-dado construction

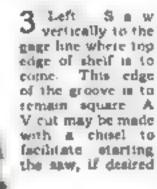
By EMANUEL E. ERICSON, Navel Manual Training Authority



2 (Right Gage for depth of groove teec 7 , mark tail or tenon on shelf to correspond, mark angles on both members with a bevel aquare



Square two lines actors the vertical members of case where each shelf so to come, and a third one It in. above the lower line in each instance. See 2

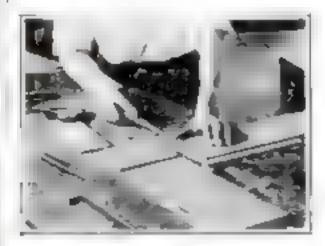




4 Make the angular cut for the groove by holding the back new at the proper plant



5 Cut out the groove with a chisel that is narrow enough not to mar the edges



Saw and chisel the tenon or tail on 6 Saw and truses the tember. Be careful not to aplit off the sharp edge. Some mechanics prefer to use a wide chiel and make the cut from the end of the wood. Work closely to the lines



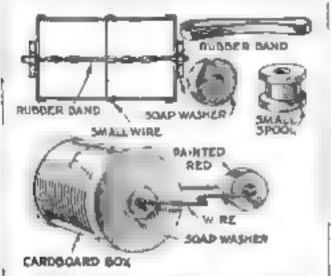
7 One should be able to slide the tail or tenon into the groovs with the pressure of the hands alone. Glue may be used in the final assembly unless the piece of furniture is to be made collapsible for ease in shipment

Rubber Band Tractor Is Amusing Toy

By F. CLARKE HUGHES

THIS month's "consider is a rubber band tractor, which will please the children because it will run.

The materials peeded are a cardboard box 21/4 in. or less in diameter, a large ramoer band, a staff wire, two disks of soup or paraffin and a small speed or other round onject for the rear roller



How the tructor is assembled. Two washers made of some or paraffin regulate its speed

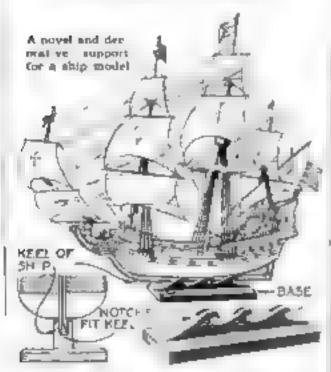
These are assembled as shown Note. that a time wire, plus of crosswise through theliox passes between the rubber strands.

The toy will be more attractive when

parated in very bright colors.

To wind up the modes, merely turn the enrelboard box a few times. With a powerful rubber band, the tractor should run 15 or 20 ft., if wound to full strength

Builds Wavelike Stand for Galleon Model



FTER building a Spanish galleon A from plans published in Popular SCIENCE MONTHLY, Floyd E. Freeman of Philadelphia designed the stand illustrated, which differs considerably from those ordinarily used for decorative models. It has the advantage that it does not interrupt the flowing, graceful lines of the hull. The model itself is the ship shown on our Blueprints Nos. 40 and 47 (see page 10)



New type of adjustment on the barrel. Positively locked in positwo after adjusting.



Shape of frame at acrell and permeta measurable around protec-tions, splaned shafes ue slotted and ould shaped pieces.



Nacrow frame makes it possible to use in places where must arrie of micrometer will not enter.

A feature of this micrometer is its adjustment for wear. It is so constructed that adjustments do not change the convenient reading position of the graduations on the hub.

The No. 11 has an exceptionally wide range of usefulness. It gets at places other micrometers cannot reach — its new frame design gives it greater measuring capacity.

The frame is of I-section for lightness with strength and rigidity. It has the popular black japanned finish.

Ask your dealer about Micrometer Caliper No. 11, or send for circular. For other Brown & Sharpe Tools, send for Catalog No. 30.

Dept. P. S.

BROWN & SHARPE MFG. CO. Providence, R. L., U. S. A.

"World's Standard of Accuracy"

New Fishing Rods for Old

(Continued from page 80)



stick to my Cheney, thanks!"

"You needn't try to palm off any other make of hammer on me. It's a Cheney Hammer for mine-first, last and always.

"Nobody can tell me they make a better hammer than the Cheney—and if they do, I'm not interested. A Chency Hammer suits me from the butt end of its slick hickory handle to the tip ends of its specially tempered claws. I've had a Cheney sticking by me on every job for years and believe me, hammers take some punishment in my work.

"So, I'll still stick to my Cheney, thanks, I like its wonderful 'hang' that's so easy on the wrist. Lots of hammers tire you to death to swing 'em all day-but a Cheney Hammer, never!"



Get No. 6-0, if you can. Then rule the joints with tissue paper and clear with a few drops of gusoline on a salk cloth.

You can grade your new winding alk with the original silk threads taken from the rod. Keep specimens from the butt section, the insiddle section and the tip lay sporting goods store will fuzzash thread in spools to match these samples.

Some unateurs choose loud and flashy eclors, but it is far better to use only two colors in more or less hall shades. Green and yellow are excellent

Many fly rods are still fitted with the so-called ringsand-keeper guides. These I should be inclined to replace at this convement opportunity with snake guides,

All rod windings ferminate with what is known as the my visible ending. In the diagrams on page 93 are shown two methods of accomplishing tios The newlle method or by far the better when making wordmes of five or six turns such user the tip section. Wen the em of the thread bas heen chanch those, work are adthe binned in some direction with your Phone and forests per so as to smooth the threads.

When you arrive at the point where the first guide is to he installed, tie down each shoulder lemporarily with a rouple turns of alk

thread; knot and clip off the ends. Then would over one of the shoulders until it is torked light; remove the temporary thread and finish the winding. Fasten the other aboulder muniarly (see the diagram on page 93).

WHEN all the windings have been made, pass them swiftly over a flame just close enough to burn off the silk fund.

If you should apply varuab directly to the silk bands, their colors would clunge, so apply a coat of thin, high grade write shelling to the windings with a small artist's camel's-hate brush. The abeliac can be purclused at sporting goods stores, if ordinary white shelfae obtained from a paint store is to be used, be sure to thin it liberally with alcohol. Go around the lands, not up and down. Wape off the shellae immediately; just enough is needed to wet the aik threads through. Mow the windings to dry from four to ten hoars.

The question as to whether the initial coat over the bambou should be shellac or varaish depends upon the condition of the

tool. If it is new or comparatively new and from good to fair in condition, it does but need a first coat of sheline. If the roll is old, my experience has been that it is wise to shellac it and hang the Jointa up to dry for not less than a week.

Generally, however, the first coat on the hambon wal be varuals. Many varieties of spar varnishes and coach varnishes are used. A clear brushing lacquer of high quality, if guaranteed by the manufacturer for use outdoors and on sporting equipment, is promibly as thurable a fair i as one could wish at any rate. It has the great asymptoge of drying

The varued used most not be too thick

and heavy, a condilion met with especially when the weather in cold. Many prefer to apply four or five coals of thus, easy flowing varaish to two or three coals of neary various. The Varo should not be coal, my practice is to place the receptacle holding it in warm water. Henry varual may be thinsed with a I the genuine sparita of Inspentine,

C Twooden phage to fit into the open ferrales of the bott and modele sections, tues a small screw eye into each, and bung up to shown on page 80.

l se a brush 🎉 or I in, wide, preferably flat, and with bristles not too soft. The entire secret of variations a rod is to use as little variation as possible and to apply that by brusing it well. Never flow the variash on tlackly, so if finishing a table top or floor. Take one tip or joint at a time. When you come to a winding, brush around the threads, rather than across them. Work m a good light. As you reach the guides. varnish under them, working with the tip of a cancel's-hair bresh ander the beginning of the shoulders, which is a valuerable place for the entrance of Water

Hang the sections in a warm, dustless room and let the first coat dry for a week or ten days. The drying process can be hastened without harm by hanging the sections in the wind, out of doors in a sharly spot.

From three to five coats of varnish may be applied, depending upon the consutency of the varmab.

When the last coat is hard, rub the rod lightly with fine powdered pumice stone and water. Wash now and then with cold water to see that (Contraped on page 30)



When rod sections are variation, they are hung up by means of plugs and screweyes

|252 |242 |448

New Rods for Old (Continued from page 22) THE START THREAD THROUGH FIG 2 THREAD PULLED THROUGH HLE - TUSHU CONS NEEDLE WINDAMS STARTES SHOULDERS

Two ways to end a winding invisibly and method of attaching a south guide

SHOULDERS TIED TEMPORARLY

you are not rubbing through the varnish. Vi agon un the auctace is natooth, dry the sections and go over the whole with dry ruttenstone, which will give it a polish A soft piece of clamous skin can be used to give a linal polish

I in fact that very few amaleurs give their rods thus final care and polishing accounts for the fact that their rods are rough rather than beautiful. The pomaing completes the refinishing process.

Clamps for Wood-Turning Lathe Save Stooping



How a wooden or from rocker arm is used to bring the camping handle above the bed

TO CLAMP the tailstork and tool rest on a wood-turn, ig after of the type abistrated, the worki ian ordinarity anist reach underneath the lathe. Advestments may be made more conveniently if the clamping device is rearranged so that the handle is above the lathe bed I us as accumplished by the astartion of a long bolt and a wooden or iron rocker. arin.—Jonas J Bybeilg.

STAR HANDY GUIDE for HACK SAW USERS ★ HAND BLADES Macerial to be FLEXIBLE BLADES SPECIAL FLEXIBLE ALL HARD CAL श्रद्धाः शर्दाः 15. 10. 0. 18° THE PARK BEES KNAM I BLOF NAME ASSESSMENT MMM 414 Large Stock 91 UF 19143F 12 (4 12 (4 WISF 12147 13. 10" 010 010 1010 1210 MISF BISF. Ordinary Work SINF or General Use 10145F 1216SF LINE 9. 15 May 10 20.00 ì, #14 #24 #24 #24 COL 114 Pipe, Drill, 1212F 記録 n: Plates, rec. 12245 F 1314F 1. 421 421 431 1231 ş-DZ\$f a" ш This Pipe BER STEEP 1025 11. HOJ2F Light Sheets, etc. 143251 17175 * POWER BLADES HEAVY-ALL HARD LIGHT-ALL HARD Orde Longith Geogra

Send to-day for this Chart

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points

Ordinary Work

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2. 111 fight S. ATT 11.

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CONSENTED OF or care set a gip pe i quemettet g tilet i e ferri g r her i v gra no m e til nå ghant sirength and ebduranet.

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CTS SHOW TI SHOULD The heat traffing metrods used a real traffic to the second of a traffic to the last traffic to the second of the



WHETHER you use power hacksaw blades or hand blades you will find the "Star Handy Guide for Hacksaw Users" invaluable.

Different blades are required for different types of work. Be sure you are using the right type of blade for the work you are doing. Get this chart and hang it up where you can always consult it when buying hacknew blades.

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If matters not how budly it is senarched searned, stained worn that unaightly old floor cohe headen forever with a cost of KYANIZE Floor Enamel: Behold overnight, a new permanently bright, clean looking, sporters thorproof agover water, wenther wear -even ucid! Won't crock crumby. phip ir pull

I multis effective on floors of all leads andoor or acidoor stancoment concrete, wood, or old puttern-worn broleum. Nine tolid colors enable you not only to paint old floors but to decorate them as will in verying potterns.

You run do it too. Send 10c for our book is called. The Cha of of Patentel Escat-ture 1 and we'll supply more of waterst Kamize dealers.

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If your dealer does not carry Krewitze Floor Enamel send to his name and ONE OOLLAR and we will forward to you prospend a full pint can of this master enamel for old floors, including break to apply it Mention votor you deare. Dust Drab, Light Yellow, Warm Gray, Navy Gray, Duck Yellow, Sich Rad, Tile Green, Golden Brown, Mahogany Red.



The SHIPSHAPE HOME

Pointers on Brushing Lacquers

How to Prepare the Surfaces The Undercoats Straightening Out Rough Spots and Laps

By BERTON ELLIOT

RS, ANDREWS, who lives across the street from us, was on the

"I ve got a fine idea" she at not need. with her usual enthusiasm. Some at the larles to our eard clat have been finishing things with the new hir were new ners. I gress I started them may war, it signifethe popular thing now bonse of them have done really more work breakfast sets, dressers, and tables, telephone stands, tilt tables, door stops, magazine

racks, buck troughs, candi-Starks, book ends, & ch bowls, and everything Of course, there were some things that dain titure out just right, and most every. body lus some que ton they would like to have me-MARIE PROPERTY.

"Well mext week, the garty s at my house she west on breathlessly 'I thought I d larve it on Saturday afternoon matend of the regular Thursday, and get von to come over after we're through playing bridge. Then those who wanted to could stay for a while and ask you queshorst, *

Four o clock Saturday a termoon found me the center of a much interested little group of amateur

painters, all eager to receive information. "Suppose we start there," I suggested, norlding to one of the women at the extreme end of the room, "and go around the room to the right, each asking a question. Now for the first one."

"I lacquered our kitchen table and chairs in jazzy breakfast room colormy first questioner said, "and you never saw a better looking breakfast set, but a spot on the table about the sue of a dollar has refused to dry."

"Your trouble is undoubtedly due to oil or grease which was not thoroughly cleaned off, "I replied. "A kitchen table is apt to have greasy deposits. Very likely some grease souned into the wood in this spot, and your sandpapering did not remove it. You sound have scrubbed the top vigorously with a good kitchen cleansing powder—about half a cupful to a pail of hot water. The surface then

should have been moved with clear water with a little vinegaz in the proportions of a post of smegar to a pail of water. Of correct na would have made it necessary to want overlaght for the table to dry thoroughly. Any a ser way to remove the grease in a case like this is to wash the table with density red alcohol."

lsa t gasoline excellent for removing greater asked one of the women.

Gasoline to often used for that purpose. It should be high test gasoling, scrubbed

on generously. There is some objection to pasaline for this purpose because it has a tendency to apread tion grease in a thun Idin over a larger surface instead of removing it. In preparing a surface for because, one must be especially cautious and, therefore, the a list evenowing methods I have mentioned are safer. At t ie mine time, gasotime is community used and in most cases, no des ht, it is quite satis-

to return to our kitchen table, since we cannot get the grease off at this late stage, I suggest that you try coaling over the agot with white shellae. It will un-

doubtedly seal in the growy or only deposts. When thoroughly dry, sandpaper lightly, 'feathering' the edges so they will taper up neatly from the old surface. Give the entire top of the table another coat of inequer, being especially careful to go lightly over the shellacked spot so as not. to cut through into the grosse again. Now, let us have the next question."

"I lacquered a dresser that had been previously finished and the lacquer seemed to act as a paint and varial; remover, Why was that?

There are several things that may have caused this. You see, the solvents used in quick drying lacquent are very powerful. Under certain condations they will soften a paint or varaisle conting and lift it from the surface. If the lacquer is brushed too much, it will pull up the softened undercoatings. It (Continued on page 3. . should be flowed



When too much brushing has left a rough agod an appropriation of sacquer thinner menalty wall attrachted out the surface

Pointers on Lacquer

(Continued from page 84)

on quickly and freely with generous brushfuls. I take it, however, that this was not the fault in your case. What probably caused the trouble were breaks in the surface, which permitted the lacquer solvents to get under the old paint film. If the old finish is chapped off, or I if it is checked or alligatored, sometimes it will do thus. Of course, the surest way of producing astrafactory results, where a high class job is desired in refinishing, is to remove the old coatings and build up a new finish from the bare wood. The most general practice in amateur painting. however, is to cost over the previous finish. Where there are breaks and abramons in the surface and there is any doubt about its being suitable for refinishing with lacquer, the application of a coat of sheller, to seal over the mirface and fill the abrasions, will, in ninety-nine cases out of a hundred, prevent the lacquer getting under the surface and will generally permit a creditable job. And if it doesn't, it hasn't taken very long to apply. and you can then take off the old finish. To remedy the trouble you have gotten into, sandpaper the surface thoroughly to amouth down the roughness caused by the lifting up of the old coating. Then apply a coat of sheller, or preferably, two coats, sandpapering each coat very lightly, and apply another coat of lac-quer. This will fix it up, I am sure. Now I'm ready for the next question."

"I USED brushing lacquer on our floor, and within a few days it began to come off. It was a hardwood floor, and

I used clear lacquer."

"There was most likely some foreign substance on the floor which prevented the lacy ier from holding tight—undoubtedly grease, dirt or moisture. The presence of any of these will have a tendency to prevent lacquer from drying thoroughly, Floor oil, wax, furniture polish. and dustless mop preparations generally are of a greasy nature, and the safest way in refinishing a floor with lacquer is to wash the surface in one of the ways I mentioned before. It is much more necessary that the surface be free from grease, dirt and monture (especially grease) when bequer is to be used than with the old type of paint and variush materials. He sare to remember this. Now for the next question "

'I did some lacquering the other day and it seemed to strag under the brush. I had an awful time to prevent showing

lams."

"It's plain to see that you are just starting to use brushing lacquer. Some people do have a little trouble of this kind with lacquer before they become accustomed to it, but they soon get the knack of using it. It's really easy when you get the idea. Lacquer must be applied with a full brush and flowed on freely, holding the brush at an angle and not straight and stiff. Don't scrape most of the lacquer off on the edge of the container and don't try to brush it out. If you do, you are bound to have trouble. Try another piece—starting in on the smaller surfaces. (introvid in page 91)



Save Hours with this Guaranteed Lacquer

"Rogers" dries hard in 30 minutes.

Just brush it on!

Everywhere, people are amated and delighted at the speed and ease with which Rogers Brushing Lacquer works, It is almost magical.

No tedious preparation is needed. "Rogers" goes on right over the old finish. This saves a lot of time. Then it does not require long, expert "brushing out"—because it covers read y and spreads easily. You merely flow it on with a full brush. This, too, saves time. "Rogers" forms a beautiful, tough colorful film that sticks tightly to any new or old surface. Then, it

Dries while you wait!

Dries in 30 minutes or less. Dries free from Lips or brush marks. Dries before dust can soon its a trous soon. Dries before damage comes to it. Dries in the track and urgent need Dries to a smooth, hard, colorf I then is that wents and securs and WEARS. Does not "print"—or gether line.

Think what this will mean at housecleaning time - when you want things done well but quick y.

There are scores of uses for Rogers Brushing Lacquer in your home right now. A few are suggested on the opposite page. Every store, office, factory and but using can use it in him-dreds of practical ways. Many industries are employing it. Try one can and see for yourself.

Dealers everywhere carry "Rogers." Comes in cane, much and ready for use, Your choice of 18 wonderful colors—also black, white and clear, For best results must upon the genuine in the "Oriental" can. Read our publicly advertised "Money-back" Guaranty to the right.

DETROIT WHITE LEAD WORKS, Detroit, Michigan Makers of Highest Grade Paints, Varnishes, Colors, Lacquets





Our "Money-Back" Guaranty

Try one can of Romes Brushing Languar. If any more than applicated, return what is left to your dealer. He is methorized to refund the native purchase principal.

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Happy, carefree miles over winding rural roads, with the fresh country breeze in your face—that's motorcycling, the sport of a thousand joys!

It all costs only one cent per mile with a Harley-Davidson Single. This new-type motorcycle travels 80 miles per gallon, and is safe and dependable. Any 2 x 8 foot space will park or house it.

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Pointers on Lacquer

(Continued from page 85)

such as chair rounds and legs. If you still have trouble, it may be the brush. A soft bristle brush, such as fitch or bear hair, should be used."

THAT remards me of some trouble I I had," said one of the women. "I ve done quite a lot of lacquering, and as a rule I don't have a bit of trouble, but the other day I was doing a chair and was interrupted when I was working on the top panel. Before I knew it, the material had set up a little, and I roughened it up into quite a 'mesa,' I couldn't get it smoothed out. There must be some way of fluing it."

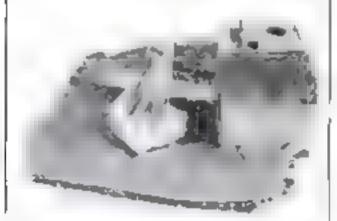
"So there is," I assured her, "although surprising y few know it. Always have an open can of 'tl inner' near by. If you run into snything of this kind, dip the brush in the tlunner at once and mop it quickly over the spoiled place. Brush just enough to straighten out the surface. then leave it slone. The thinner will pielt the lacquer, as it were, so that it will usually flow out again and level itself without showing brush marks,"

And here the discussion ended, for no one could think of more because problems.

If you have ques ions about brushing lacquer not touched upon by Mr. Elliot, he will be glad to answer them by mail. Please inclose a saif-addressed and a amped envelope.

"Dustless" Door Mat

UPON returning from the garage or cellar workshop, one is ant to leave footprints of concrete dust upon waxed or polished floors. Wiping the feet hastily upon a mut at the door will not always remove the white dust. If, however, the



If treated with a little oil, a cellar door mat will take up concrete dust more readily

mat a impregnated with a tempoon of light machine oil in a part of gasoline, the very act of walking over it will be sufficient to dust clean the soles of one's shoes. This small amount of oil in a mat will not course only marks to be left upon rugs or carpeta - R. WAILES

BEFORE applying white enamel, fill nail holes in the woodwork or plaster with putty made by thickening flat wall paint or enamel underconter with cornstarch or whiting. This will not discolor the enamel. later as common putty, made with linseed. oil. is apt to do.



For that clean-cut look of success

try this invigorating massage after shaving

SUCCESSFUL men look the part.
They are clean shaven, clean cut, and well groomed. They have that glowing look of health and vitality

A muddy, half clean, blackheaddotted skin can never be a partner of the successful man. Yet you can have the clean look of success. It takes no extra time. It can be acquired easily and pleasantly in your own home.

After you shave, use Pomperan Massage Cream. You usually use something after shaving-hot towel, lotton or cream—to remove the dirt and clinging soap particles that become imbedded in the skin. Water, lotions, soaps-all reach the surface only. They do not remove imbedded dirt and secretions Pompeian Massage Cream does.

Use this pleasant, gentle cream after shaving. See how your skin takes on the glow of life and action. See how imbedded dirt, even blackheads, rolls out under the mild but efficient urge of this quickly applied massage. You will like its restful, zestful "feel." Above all, you will like it for the feeling it gives you that-by gosh! you really are clean

Made this consisting hand for front Wash your hands theremakly Ruba little Puniperal Marsage Circum may the back of your hand until the cream arm dauppers, then comes our again. Nonce that our the found to the first the first the first than the course of the first than the fi this — the court pay in part and ones we black. The black



is day that you could not re-move by watering. You can make that sample but a m-you into test today. Our a sar of bumpoun Manage Cream n any drug store for fixey cents if you prefer to make the sent before you buy, mera-ly mail the coupon below.

POMPEIAN

Increases Your Face Value

FREE - TO MEN ONLY

The Pompeian Company, Dept. 31A. Cleveland Obio Please and me fret, the sample take of Pompeian Musage Cream, with enough cream to make the hand cest, and to give me several COMMERCE.

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Worth While TOOLS

The kind of tools used often determines the quality of the work. To be sure of the best results, get the right tool for the purpose. There's a large variety of PEXTO Too's made in all practical styles and sizes. You can't go wrong if you insist on these century-famous tools,

Write as for Booklet

THE PECK, STOW & WILCOX COMPANY Southington, Conn., U.S.A.



You Can Build a Viking Ship

Our Blueprints Will Assure Your Success in Making a Highly Picturesque Model

By CAPT. E. ARMITAGE McCANN



Capture McCoun at work an the brest Posturan Screece Mostrocy ship model. Full one drawings of the stop are contained to Blueprints \$1 and \$1 (see page 10).

OLAF TRY GGY ASON S long serpent "had therty own a sole one of Carnie the Great's ships had sexts. The Viking ship model we are having is a sextensesse, with sixteen a side which means that her prototype had sexts four rewers and a crew of from seventy to eights.

Those who would like to bodd this most sof a Viking step but have not read the two previous articles in April and

Max can obtain fell size drawings of all for parts and a coincide list of materials by sending for Home Workshop Blueprints Nos. 61 and 64 (see page 101).

The must step (page 99) may be mode next base block is notched underneath to take three frames. The must steps in a square hole ५ m. deep, located I Is in from the forward end. Lee a piere of straight geamed pine or a 3₂ ui dowel stock 12 m. fong for the mast. Taper it to about one third less at the upper end.

Step the most god on the aftende of it erect a post is an equare. Next make two side chicks or partners is by is by it by it in and cut noteless in them about is in aquare to receive the wedge that holds the most apond to character of the keelson.

To factor a root and hours or other

Fo fasten a post and beam or other light parts for ether bore nearly through them and press in the part with the phers as shown on page 80, May none. Cut off

the end and cinched in practice the writer has found it as visable, where possible to use the lambde pain or pegal to another give as a modes has to stand rough usage and many or shoughth of the feather duster

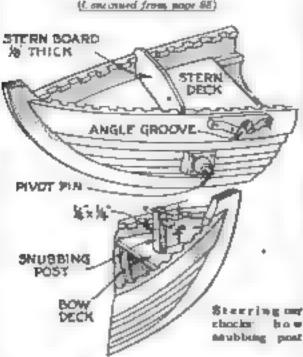
On the a ter deck piace the atern board (page 90) Then we may as well make the checks for the steering our Both are of semi-The liard wood. upper to 15 by 16 in. It is glued and narkel outside to the gunwale on the starkourd aide with its center about 16 I outsused on page 99,



Stern of the formout Ourberg ship, which was dug up in a remarkable state of preservation

A Viking Ship Model

(f. one crused from page 88)



in, abait the front edge of the after deck From the p ank on which the belissman stood or "steerboard ' side, comes our modern name of "starboard" for the right-hand side of a vessel. The other was the "leerboard" or "larboard" spic, oreaning the empty aide; thus word larboard was later changed to port, to save confusion. 'Port' is from the Portuguese, mearing the open asie, which was laid next to toe quay

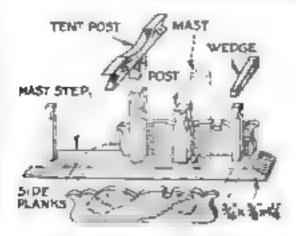
The lawer chuck is like a cone on a board. Take a piece \$10 by \$1 by \$4 uc. cut one fint a de to fit on the planking 34 in (center to center) below the upper clock and 14 in, abatt it, and through the center hore a danting hole by in in dimmeter. This hole is at a right angle with the keel and horizontal when the block is in position. With the outside end of the hole as a center, writtle the block to the shape of a cone with flat ends, and glac und an in pasition.

From the middle of the forward deck. there projects a post for the anchor cable.

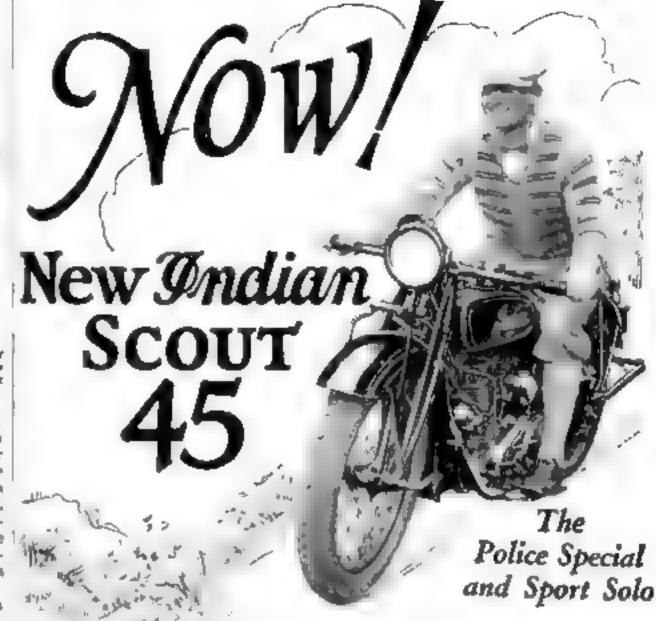
as shown above.

The applementary carvings for the head and tad of the dragon may now be made. Fret-saw two outlines as shown on page 100 and full size on Bineprint No. 61. Nate that the outhire idders from that of the centerpiece. With a kinfe or other took, carve them to make prominent the ears and the made, cut in the center of the ears and the eye sockets; cut the teeth back a bit from the edge of the lips, and run an incised line to mark the outside of the bus.

For eyes, I glued in rubies from a (Continued on page 100) bolion counter



Mast step with one side plank moved out of place to show the construction.



ow for the fun! Now for the thrills! Now for the big 'kick' of outdoor sport at its best! Here it is the new Scout 45 - inviting you out to a real world of adventure!

The Scout 45 has a super-powerful motor, snappy acceleration, large oversize brake, classy sport handle bars. Holds boundless power for the veteran rider, easy handling features for the novice. Takes you anywhere—any time—and brings you back safely. Ride the 45 a mile-and see what a champion sport solo it really is.

Easy to Own

Call on your neatest Indian dealer and and how easily you can own a Scout 45 under our generous pay-as-you-ride plan. Or mail coupon below for the complete interesting story of this popular model,

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A few territories still open for agency of Indian Morocycles. Wonderful opportunity to rambitious, energetic men. Write today for particulars. Address. Dept. H-6, Springfield, Mass.

Indian Motocycle Co., Dept. H.6, Springfield, Mass. Send me FREE descriptive circular on the new Indian Scout 45. This places me under no obligation.

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Make big money from repair work



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Toy "Sub" Dives and Rises

By Hr SIBLEY

WHIS bathtub submarme, properly I balanced, will perform amazing feats. When released on the surface with planes set for submergoig, it starts under with a where and gargle and a stream of bubbles from the air oatiet back of the coming tower marks its course. It will turn in a limited space and will come up gradually after the speed slows down.

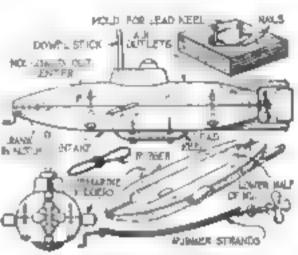
Any easily worked wood may be used The ballast can be melted from scrap lead. Have the mold large enough so that the keel can be filed down into the "sees water line is just over the propeller when floating idle. Make the gulyanized slav t iron propeller as large in dinineter as the rudder supports

perintt. The rudder sud elevating planes will swell on their axes and be tight eposigh to maintain any position in which they are set.

Paint the best slate gray and apply several coats of spar Varnish. Bright verturbush will set off the properler to nd-Varilage, and a row of hypes-bounded ore holstery tacks will



The toy salamerges like a real aubmaring and when the motor runs down comes up



Most the "sub is made. The buil proper is 10 sa. long, 215 st. wide and 1 in. deep

give the appearance of givets.

It goes without saving that the little submersible can be made in various sixes. Lightness is not a requisite; in fact, a heavy wood would be preferable. If a larger best is halt, the motor can be made with heavy puring hunds each as are sold for mostel. entplanes.

You Can Build a Viking Ship

(Continued from page 89)



To complete the deagon's head, two fret sawed and curved peeces laws to be added

henoch. This is very effective, but red heads or pinheads painted red will serve.

The dragon's or serpent a head was made as fearsome as possible to frighten the enemy and had eyes so that the ship rould see to keep out of danger, as with Clunese boats to this day.

The tail is the natural complement to the head. Two small aidepieces are cut to the shape given on the biosprints and carved with a flowing tail effect.

All four pieces are glaced to the centerpiece and clamped until firm.

The hull is now ready for coloring. I

gave all of what we have so far made, with the exception of the long posts, a cont of rather dark oak stam-a little darker outside than inside. I then took some black stain and painted all the outside of the centerpiece, including the head and tail carvings the outside of the gunwater and the mapt step. When the stant was dry. I rubbed the full diagonally and very aightly with some fine steel wool to remove a tille of the stain from the edges of the planks, thus emphasiong them.

Everything was then given a thin east of shellar varnish. The long posts of Frown wood were varnished only,

The tongue is bright red; made the ears and along the jaw, a doller red. The teeth are gilded, as are the edges of the ears, mane and eyelrows. At the tail the curved phones are gdt. The scroll work along the stem, stern and keel, to be described later, will also be get. This gold work should be reasonably bright, but not too glaring.

Next month we shall make the rest of the anull parts, the sails and the base, and finish the decorating.

To MAKE a light gray-green stringle stain, nex one part pure boiled leaseed oil, one part flatting oil and one part creosote. Add a little white lead to give it body and Int with chromium axide, touch down with a very little lampblack.

Blueprints for Your Home Workshop

ANY ONE of the blue prints usted below can be obtained for 25 cents. The blue prints are complete in themselves, but if you wish the corresponding back come of the magni-



Described

rine, in which the project was described in detail, it can be had for 25 cents additional so long as copies are available. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

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City and Ships



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Any one can ope ate. Four new 1929. Johnson Motors offer speeds of 6, 13, 22, and 23 m. p. f.

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Make More Money

Read the Money Making Opportunities on pages 120 to 143 of this Issue.

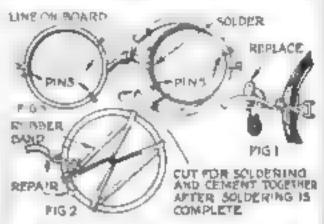


How to Repair Amber Rim Eye Glasses

I MITATION amber used in so-called number run glasses is a form of celluloid, which often can be repaired satisfactority by using celluloid central.

One of the easiest repairs to execute is the replacement of a small piece of cellules on the tesse piece of nose glasses big 1. It is necessary only to I dd the classes in position so that the gold piece with its two rivets is but. Dut on a quantity of the classic bar touching size that it rus in around the rivets, then blow it is hitle to have a the outer saile. The following day use a fine file, a had file will do— to dress the consent flat.

Another sompor job is to cement a broken run together. None glasses are generally fitted with a celluloid run with out a brass insert and break easily. To repair them, put the lens to place and hold the run tog tage with a runner band as shown in high 2. Out or file a V shaped grouve at the post and fill it with rement.



Three types of reports that may be made to ambee glasses by using celluluid sement

To be doubly safe a thir piece of alrest cells lord may be covered with cerner, and had over the joint that as tribution after the cement is hard.

If the erack on its holer the gold clip, put remed on each end of the rici and claim together with a rabber band.

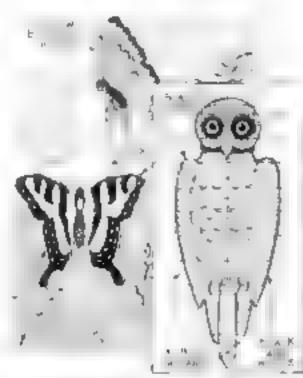
A third is a moner repair job to to gorder a nose press to the gold rail resert of mather rain glasses. Remove the renses and bows by loosening the serews near the how bringes. Mark the looses with garnined stockers so you can replace them properly when the position exemples.

Out the collision rank! The nose precess that it can be supercapar. Last the frame of a soft board on what is a string it line has been previously drawn on the lunges are ends of the nose precessable had be lunges are the frame at place by driving three or four pass around made of each real and benting them over the fig. 1). Spread the ends of the celluloid run apart and hold with pass so that the heat will not meet the consection.

socies with an non or torch, being very careful not to continued idead. Then true the amber run-to-compensat, for the addtional metal on the frame. Remove para and concert the frame together as previously described.

The cement may be colored, if desired by dissolving a piece of colored celluloid that.—Boyo R. Any not

Fret-Sawed Plant Sticks Enliven a Garden



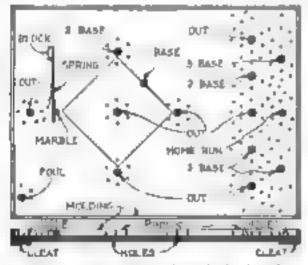
Three designs for plant macks. The butter flies are 7 or 8 is. long, and the nect. 10 is.

MESE plant sticks are excellent projcets for those who find pleasure in susple woodwork. They are made with a coping saw, painted in bright enamel colors, and mounted on sticks In insquare and about 80 m. long, or long enough to being them in their natural relation to the foliage.

The wood should not be more than 14 in, thick. When the forms have been cut out, it is well to give them and the sticks a coat of white lead and oil before coloring them. The sticks may be painted greet or brown.-- C.A.K.

Easily Made Baseball Game for Young Children

A BASEBALL game for amissing small chrotren can be made as shown below A baselial diamond is laid out on a piece of wallboard 3 by 4 ft. (or analler).



Top view and sertion through the board The obstacles around each hote are sails

and holes slightly larger than the marble to be used are bored in the positions radicated. This is glued on a foundation made of wood or wallboard. Then 154in, wire brads are driven in where shown, and a spring arranged to "bat" the marble. The result of each "bit" is decoled by the hole in which the marble rolls.-W. J. Ensiones, Jr.

LIFE IS NOT WORTH LIVING

— Without Sound Nerves

COUR moves govern your life - your efficiency, your happiness, your health. If your nerves are depleted, you cannot concentrate or think eleurly; you have not the "pep" and sparet to enjoy your pleasures and sports, you have not the physical comfort an we being without which happiness is im-Is life worth possible, hving under these conditions? Not You merely exist you are not getting not of life everything that it has to offer?

We are living in an age of SPEED; we are leading it year! We hurry, we worry,

and often, we dissipate our vital force t West committed these tireach american one because we are living in an age of scute competition, tremendously high cost of hy my resumes pleasures conclusions. that compel ut to strain our nerves to the

Yet, we go on living our lives hard and fast, little realizing that we cannot go on for long, that there must come an en- toour stock of Nerve Force, and that Nerve Exhaustion is staring us in the facel

Every victim of Nerve Exhaustion, when he is stricken with this termble malady, tards to be a that he has been straken madency. This is not true. The Co. tax it has been poora developing, and that he has had many, many warrings of white was coming-but he and not beed there! Though he passes through years of subnormal nerve supply, he pays no atten as , he believes it quite common-as many misled people do-to feel tired and worn out to suffer sleepless nights in periods, to feel discomfort after meals; to feel depressed, process on mobile and often in a run al fog He water as trackle will see a 1 H some Law some time " a day I may "nothing physically wrong Lat as his organs are perfect," that I hand an employment be "clear" A lattle rest helps a little for a while, and then he is right book where he started, become the value of the branch be many manufactions of werson fort ? are known from the se the group is state good In he sine he remove to every fay he is underproping his common parts, parting t was to a not soft ob and and mental dis-Or her and going through the only HALL

The country is teeming with cases that fit this story like a glove, for we Americans are the most nervous nation under the son, not barring even the hot bended Latins. They may be called "near-neurasthenies A near-neurasthenic is but a next-doorneighbor to a full fledged neurosithern on the grap of actual, terrible and complete Nerve Exhaustion-Nerve Bankruptcy!

There is but une malady more terrible than Nerve Exhaustion, and that is its Only those who have kin, Insanity. passed through a siege of Nerve Exhaustion can understand the true meaning of this statement. It is HELL, no other word can



PAUL YON BORCKMANN "mile-a-manute" hie. We arrive at Nerve to a six various crowd two, or even for Breather the fact that the reality years of life into a single late the same of what have been trans-

CXI STORES IT At first the to put to africal lite to me, and at it grips homdeeper he is afraid he will parent se great is his mental terture. He becomes pame-stricken and irresoto a A stokening some dum in a skip - same be a senior overcomes han, He becomes Assessed with the hought of self-destruction.

The sym doms of Nerve Exhaus not vary necessary the strong property of term of the ties, but the development is tomails as follows stage-lack of energy and endurance; that tred feelrng. Second stage-nervосклени, ренценивами, месть to snow armon by of hear, negative and gestion, sour stomach, gas in

bowels, consequation, irregula heart page memory, lack of mental endurance, dizzinext bradache backa be, merris cheumateria, and other paint. Tord stage serious mental disturbances, fear, undue the element of temperates, and in extreme cases, insunity

If only a few of the symptoms mentioned apply to you, especially those indicating mental turnoil, you may be sure that your nerves are at fault : that you have exhaunted your Nerve Force,

Perhaps you have chased from doctor to doctor secking relief for a mysterious "something the matter with you." Bach doctor tells you that there is nothing the matter with you, that every organ is perfret. But you know there is something the matter. Your doctor may prescribe a drug-a perve stimulant of solutive. Leave nerve tomes alone. It is ake making a treed home run by towing him behind an autottelaic

And don't be decrived into beseving that some made system of physical energies on better the market system of physical energies on the best in the process of the nerves as the united of as that have learned through his control to a learned to an Acres of the learned through the control of the learned through the learned 000,000 122 तीय जाका विश्व स्था ता संग्रह्माता केल्ला of the organic and mental disturbances that originate in nerve above.

Over a million copies of my book. "Nexus Force" have been read by people with high at any nerves who have heartest through my advice how to ayout nerve strain and how to care for their nerves. The Address Paul von Beeckmann, Studio 141aX. 10 s 40th Street New York City

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6 physician switts at follows: "I am writing was as a Grednate M D, so my that I have carefully read that e riven brook our Never, It has done me to be a une acred than an thing I have teen so resed and I have been telest I paid for it. It is empaceable to read it without footing the souterful Truths a reveals

I had eather arises. I had the apparently of reacting I am I in the human's figurest both Never For a I rempleted a in one readers. One tree's at home and understands un air med oftens a recomper necession, heat and remarked. That bear meet me from usual do be alled heart trember should to make to write the ... I done nothing of the hand I an word viscous

Play Arbor Keeps Boys Happily Busy

Has Work Bench, Tool Chest, and Tank for Toy Boats

By HI SIBLEY

OTHER S problem is to keep the challen interested outside the loose father's is to keep the varid booking something more ke residence property that a punk yard. And the problems are complicated if our twester an apartment or bungalow court, where the back yard, if Bay 18 yery restricted respecally as hove will be boys, in challing the neighbors

The arbor playlasase illustrated is a simple but yers effective solution. The most attractive playhouse built, hy itself, will not keep I very have interested all the time but by the adoption of a

work bench, toy chest with lock bout tank you will find the vie in it a great part of their time ever they will be accupied in wholesome recreation.

The particular playbouse has the double advantage of being inexpenses to build and serving as a bome for all the toys a at accumulation of odds and suthat otherwise would litter up to and till closets

Most reportant of cores are thick, for it is no old elil tindera was a not (ascenated by paying with boutparticularly with those crude but beloved ceaft of his own construction.

FOR the arbor itself all that is required for sex process 2 by 2 m by 8 ft and ten pages I by 2 in by 8 ft. On softle latter is cut up at to diagonal braces for fac corners

A four is not absolutely necessary but is worth more than the added expense, us some water will be slopped out of the bont tank. In the original of this desired t in floor was made up of odds and ends of boards picked up in a vacant lot this served the double purpose of cleaning up the lot and providing free floor material.

The boost tank, while is simplicity stself, will keep the children interested for hours at a lane Ally size or shape can be made in this type of construction. It is well however, to have it å or a ft. long, or even longer, to give a

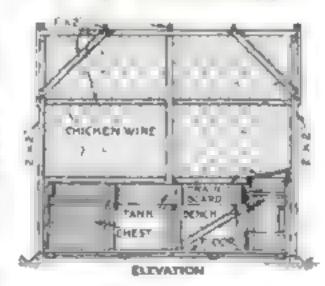
fair run for the self propelled Diring the hot weather the boys can actually get into the tank and spash around w thout duringrag t However it is purposely high up from BIN FOR WOOD the ground to make it more

difficult for the

children to get



A general view of the action and the best tank which has beene a bendiest ships on their maden Yeyages





Typical elevation and plan. Both arrangement and dimensions may be modified

in it and to kick dirt into it. On account of the accumu-Intron of debris in the tank paper, stocks, even midthere should be a drain hole an inch or two in diameter to carry off the dirty water. In California, where the original arbor was best we utilized this water during the dry superner senson for pregative The plants and sines, at my baastronding results back to curry has its particular variety of fast-growing plants here we placed morning glories on the cast, and Japanese horon the west and north. These completely covered the frame,

they were set out between the

of magastron sately. On the outpr di la row of har gones and, cas planted. All were a losen for fast growing an the actor was halt on a caesast lot and, therefore, temporary a curane at location, genues, noney-ivy could be used as a covering.

F NO lot is available large enough to bore a 116 or 2 in hole, mark a circle and dull imaler notes are rul this, they cen the holes with a closel and or in with a jackkinde. Aluke a tapered wonden filing wrap a piece of coarse sandsuper are and the toper, and rotate in hole notel the latter is smooth. This is the same proviple as scating a valve IN A BROWN IS I INTOF

Redwood was used a the original tank lat any cleur (crose wid dr. "His beveled eages of the bottom and side precen as well as the cars proces, permit the hot far to fill the posts meels. A drain beard set at one cut will serve to he if the south when but in the

The toy chest can be any large box The cover is made waterproof with roofing paper or other material and fitt district binges and a padlock lasp.

The space underneath the work beach will note once and coals of boards to be drawn upon when needed for the construction of new vessels and toys.

To make sure that too much litter would not as initiate around the workshop, an incaserator was built near by This is simply an old wask boiler were the bottom knocked out, around which is

banked an anotic wall. There san ask the door in que sale.

It is nothing less than astonaslang now march work has been done in this arhor. The boys have brilt tox transportation units for travelrig by a.r. water and land.



DEVEL EDGE AND FILL EREVICES) WITH TAR

How the wooden host Lunit is put together



A simple way to con-

ntruct the work beach



SHELLAC can be preshed to such an extent that it makes a perfectly clear solution in alcolad. It then becomes in wh more valuable to the home worker than the common commercial grades of shellac-It can be used for protecting pictures and other delicately marked or colored surfaces; it also can be used as a finishing varnish on woodwork with the great advantage that it will not turn white or spots as orderary sheliae is apt to duwhen affected by it astire.

Orange or flake shellae unually contains about 6 percent wax, il percent pigment, and B percent said, wood fibers and other reparties. To remove these, dissolve 2 tablespoons of sodium earbonate in 2 qts. boding water and add 0 bearing tablespoons of flake abeliac. Cool the solution. The wax and other impurities will float apon the surface in a solubled mass. which may be removed by filtration.

Carefully acidify the solution by a ring slowly a few drops of bydrochloric ne 1 wire constantly stigring the equal. This operation quest be carried on is a glass or porcean yessel. The granular light brown or yellow



Preparing a filter to straig shelloc

precipitate is collected on a fliter and is inglied in boiling water to remove excess water and to leave the shellac barder.

A good varnish is prepared by dissolving S on of the part jest s jetlar in 1, pt of renatured alcohol. Should the solution at if he moky, the sheline probably has been addressed with room and is not suitable for fine work

Shedae is an excellent liquid filler for close grained woods, but it will not fill the grain of coarse woods. It can be colored by the add-tion of alcohol soluble. deed or concentrated mental stars, these should be added to the pical of before the shell at has been it soulved in it.

A floor varuesh tray be made by using thick turpenture (Venice turpenture) or cannized turpentine (two parts of the latter or one of the former) with twice its weight of shedge dissolved in 10 parts (by weight) of alcohol. This varnish is more flexible and, therefore, of greater durability, than shellac and alcohol alone. but it must always be remembered that shellae is quite soft compared with some of the other varnuh gums.

Varnished and abeliacked forzuture ordinarily should not be touched by water, although a moust and slightly somey cloth may be used to clean the surface I hadly sopert. Otherwise a few drops of furniture polish or light lubricatme oil on a cloth will revive the finish.



No. 10 \$290 with Meter

You ought to have this handy Parks in your shots. It is a compact complete. machine designed just like a big productwo nutrit at one-fifth the cost. Includes Ninch cycular up and cross cut saw with polished cast ateel saw table, 10-inch band saw with tilting table for hever sawing, o juch jointer, and motor operating from any light socket. Just plug in and go to work. Fits in a corner of your basement. Does any kind of califiet and joinery work. Add lathe, shaper and other attachments any time at small cost. For the man who does "odd jobs" in his off time this Parks is a big money maker Turn out as much as a four-man shop working by yourself

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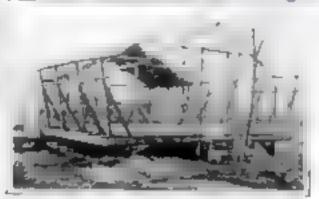
metal. Look for the AT KINS name on the blade We will gladly send you descriptive folders of "Silver Steel" Hand Hack Saw Blades

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4 to South III new St. MATHRITICA S

How to Build a Canvas Camp

(Confinited from page 7.5)



How the platform and framework book by fore the cunives sections are put in place

may be morried where desired after the sections have been newed

Brass grommets are placed where the guy ropes are to be fastened. These are inserted on the edge with a psuich and die that can be obtoined at any wellstocked bardware store.

If a shower bath is desired, it can be constructed as shown below and envered with wood, or with borising or roofing paper. The roof is wood, covered with recofing paper

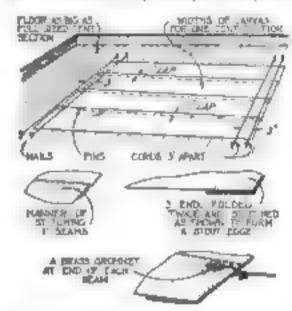
The roof of the tent itself can be wood, if preferred, like the roof of the vermula. Of course no guy ruly would then be

The lumber list for a camp of the size. illustrated is as follows

bor foundation, 9 or better 18; per 8 by Bun by 24th coordinat pools and Tipes 4 by 4 in. by 19 ft ift in sak or yellow pine will

For the lent proper 7 per \$ by \$ in by 17 Ot Bin Book worts Then The Oin by 13 ft., ernor floor product ends. It per 2 lev 4 on, by fiff), tent guy rail posts 8 pes 2 by 6 in, by 5 ft. 6 in. tent guy rail post beneve: 6 pes. 2 by 2 in. by 15 ft., lent guy rails: 6 pec. 2 by 4 in by & ft. 6 and stude: 6 peak 6 by 4 could be 13 ft. plates 4 per 2 by 4 in by 8 ft 6 in refters;

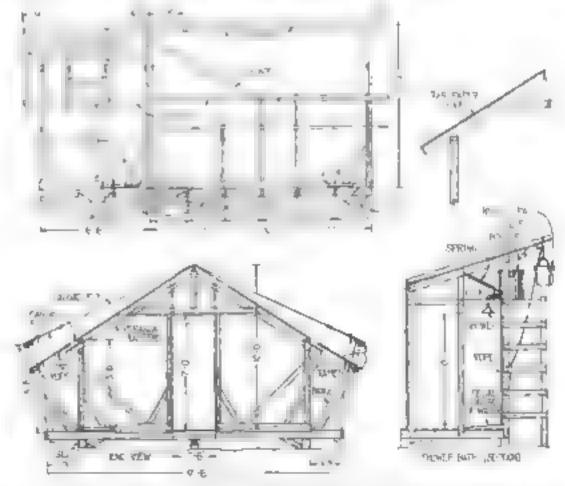
1 pc. 2 by 4 in. by 15 ft., ridge pole: 2 pest. 2 by 2 m. by 8 ft., radge pole braces, 12 per. 2 by 4 ft by 3 ft., corner braces, 2 pes. 2 by 4 m. by 7 ft., door posts; 1 pc. 1 by 5 m. by 10 ft., from door top piece; I pe 2 by 4 n by 9 ft cross door top parce; 2 pen. 2 by 4 in by 17 R. 6 in., plates on floor (across verancle and house); 2 pes. 2 by 4 m. by 6 ft., plate on floor at door end, I pe. 8 by 6 in. by 5 f ...



Each conver section is laid out on the floor, pinned, and then heavily stitched

rulge pule support: 2 pen. 2 by 2 in. by 2 it & in alone transcent pieces, 2 pen, I by 6 in. by 18 ft., floor nides at moles; I pea. I by 0 a by 0 ft., floor sides at end, 240 sq. ft. flooring

For versions, 2 pen 2 by 5 in by 14 ft , floor posets, if pear I by 6 in by 6 ft . Soor miles at end, I per I by 6 on by 6 ft 6 in , floor as less at aidea, 4 pea 4 by 4 in 1-y 7 ft ft in, piates Riper. 2 by 4 in Try 2 ft audiers, 5 pen. 2 by 4 in by 4 R P n., study R per, 2 by 4 in by 3 It curper braces 2 pear 2 by 4 in. by 7 ft., door posts. I po it by 4 in by 9 ft. 6 in its ge pose 4 pear 2 by 4 in by 6 ft., veranda rail, 115 og ft flooring 130 og ft abentling for



Side and end view of the framework, details of the versads roof, and a metion through the abover both, which is built enturely separate from the canvas bound

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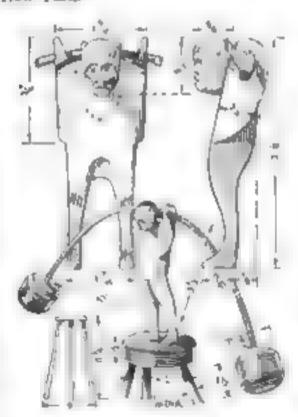
REWARK-ABLE SITObat is this wooden mankey It can balance on heels or locs in the most grofesque and apparently impossible pos tions and do all sorts of weigh, thy thuic dances.

This novel toy, what it is a far mite. or India, usually is ma le of teakwood, hat it can be whitetled from any

It can be made in hard torga wood various sizes and forms, but those indicated in the drawing below have proved ast startogy

The opinieing weights are of wood, and the bar which connects them and passes through the figure is stiff reed. Too may be heated slightly and bent as necessary to obtain the most perfect belauce.

The model illustrated was made by a craftsman in India from teakwood. It is owned by Howard Wheeler of Baldwin. New York.



Front and side views to aid in whitting the figure; the balancing weights and plotform

Applying Lacquer to Metal

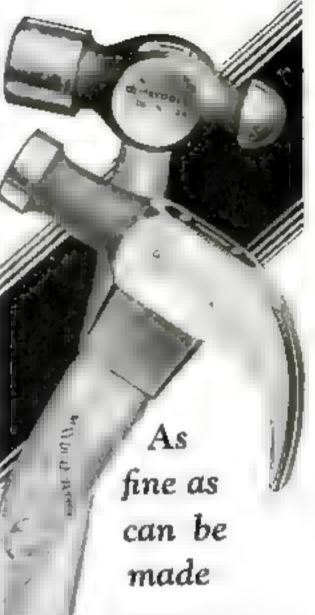
TOOL for applying lacquer to flat A metal surfaces, which is in some respects superior to the cam-

A great for lacquerity

el's-hag brush usually employed, is nothing more than a paddle shaped prece of eight hox wood about 1 m. wide at the end arreand which a piece of velvet is glued. A wider swab is useful for dusting photos W J E



hanging by his tors



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A Ball Bearing Merry-Go-Round

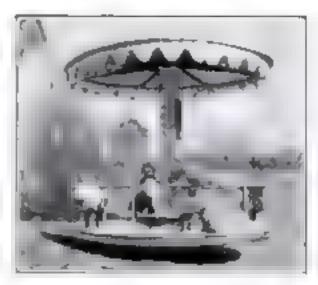
WITH a few paces of humber left over from building a house, an iron post, two discarded automobile bearings and some canvas, W.E. Robertson of Pelican, La., built the merry-go-round

A 2-in, iron post 7 ft, long was set in the ground and fixed rigidly upright with concrete. A ball bearing was placed over the post on the concrete. On this was set a piece of himber 2 m, thick and 12 in, square, a 2-in, hole having been bored in the center.

The bottom frame, in the form of a large cross, was made of two pieces 2 by 4 m. by 8 ft., with an outside rim of 1 by 4 m. boards. The frame was bored to go over the post and then fastened to the bottom of a long, narrow box made to include the post. It was also fastened to the block resting on the balt bearing.

The frame was floored with light boards and fitted with a railing of ½-in, pipe set 16 in, above the floor. An 18-in, opening was left for an entrance and four scats were fastened to the floor.

Over the post and within the upper end of the boxlike casing, a roller bearing was placed. The awning frame, 8 ft. in diameter like the floor, was made of four 1 by



This easy turning little eserry-gu-round was made almost entirely of odds and ends

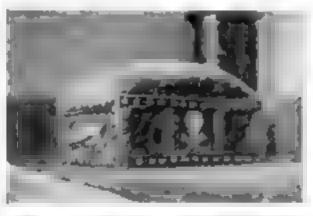
6 m. by 8 ft. boards, tapering from 6 in at the center to 1 m. at the ends. The outside run was formed by 34 by 2 m.

I shally one chief with in the entrance pushing on the ground with one foot to keep the merry-go-round turning, but the fraction is so little that a child in one of the cents can keep it moving amply by pushing on the ground at intervals with a stock—D. H. Rust.

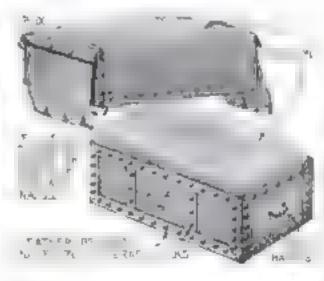
Footstool Made in Form of Old Treasure Chest

A GROCERY box, some tan canvas from an old army tent, a piece of leather belting, a discarded cushion, a few brans beaded upholstery nails and various olds and ends were converted into the treasure chest footstool illustrated.

The box was turned upside down, padded with the cushion and covered with canvas. The edges were trimined with leather belting and handles were added Then a skull-and-crossbones design was pointed on the sides. L. A. Lastacz in



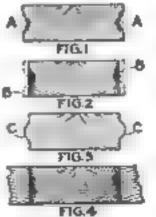
The foctstool is a grocery has padded with an old rushics, overred with canves, and arpenented with leather belting and tooks



How to Make a Wooden Joint Water-Tight

WOODEN tanks, pipes, decks, floors, partitions, and siles can be made water-tight or practically so if the joints are prepared as indicated in the accompanying diagram.

The edges are grooved by compressing, not removing the wood, as at A. Fig. 1. In the absence of suitable tools or machinery, this may be done by humineting or pressing a steel rod into the edge of the board or plank as far as can be done without breaking the



The four steps in forming the point.

wood fiber. The edges then are planed to the bottom of the groove, as at B. Fig. ?

If water is applied at this stage it is obvious that the compressed fiber will expand, as at C. Fig. 3. Therefore, when planks or boards so prepared are mailed edge to edge, the effect of mosture is to make the joints watertight.

Any blacks nith that forge a flat, hookake tool to be used with a banimer in making the groove.

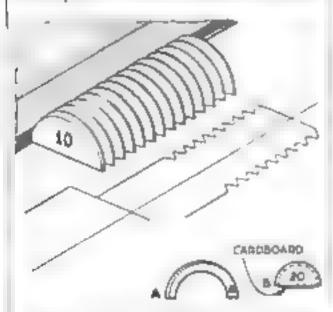
Quick Way to Draw Screw Threads

BY HENRY SIMON

WE THINK of the simplest things inst. This is persiaps the reason why it never occurred to the writer until recently to make thread templets like that allown in the illustration. Nothing could be sumpler or more effective and rehable than to use the cross section of a screw in making a drawing of that screw

thout all that is required to make one of these templets is a piece of smoothly threaded stock, a hack saw, and a file If the saw is used carefully, two templets can be inside from each piece of threaded stack of the larger mass. Ends of standard cap serews make good material, as the threads on the better makes of them are samuel and true.

The surface of the section must be straight and parallel to the center line. Its Leight should not be less than about three quarters of the radius of the outside

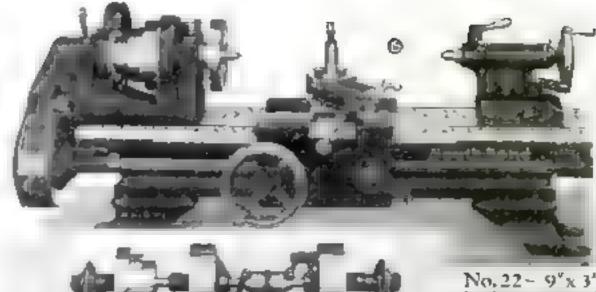


Templeta to aid in drawing full vire threads rapidly can be made from extensis cap acress

of the thread, as otherwise distortion of the thrend form occurs. For instance, a templet made from 14 m. stock should not neasure less than 36 in from the top of the thread to the foot surface

Where no surface grander or miller is ayadable, a good way to finish the surface of the cut is by placing a large, fine fint fire on the beach and rupbing the piece on the file. In any case the surface should be fin shed by rubbing it in this way on a fire or stone, in order to remove the bares left from the former operations. The working edges are then given a final amoutling by drawing a piece of leather over them.

It is astypable to use for the finer threads SAE threaded screws and USS for the coarses tempiets, because in that way there will be the least variation w the size of the templets. For example the 20-thread templet can be made from 19 20 SAE. From 1 to 2 in, will be found a convenient length, this depends on the size of the thread. Templets of very large dameters should be made from stock from which the center has first been drilled out, as shown at A, as they will be lighter and time will be saved in finishing them. The number of threads should be stamped upon (Continued on page 110)



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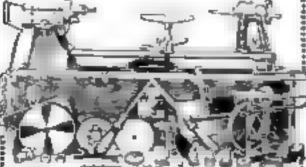
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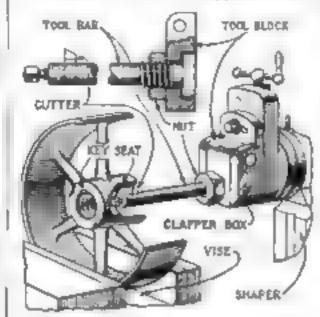
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Using a Shaper to Cut Internal Key Seats

WHILE the larger shops do their keysealing of pulleys or gears on special machines and the lone mechanic m a factory repair abop must cut liss with a chisel, there is a stage where neither method is exactly suitable.

Small shops frequently do such work on the shaper. That, however, is not so easy unless the proper equipment is provalid. The accompanying illustration. shows a tool holder that is useful for this work. It fits in the clapper block in



A shaper tool holder for beyonging, which replaces the tool post in the clapper block

place of the mutal tool post. A large nut

Notice that there is no set screw shown in the side of the chapper box, and that the tool cuts on top. With the tool catting on top, there is no need to keek the chipper. Of course, the same too' holder can be used for cutting on the bottom or side, as for die work, but for keyseating better results will usually be obtained if the Gol is made to cut on top: gs skown. —J. k.

Quick Way to Draw Threads

(Cantinged From page 2000)

both ends, or a flat can be filed on top and

the number placed these

For the finer threads, it is best to glue a pie se of carsiboard about .010 in thick to the foot aurince, with the edges about in to, back from the root diameter, as shown at B. This will couble the drafts man, by slightly inclining his pencel to get under the edge and thereby to produce a more accurate form.

There is no comparison at all between the rapidity with which work can be done. with one of these templets and the usual was of basing out the thread, with disider. and triangle. The templet method lays the work out so that the division is even and true. Pur cturing of the paper with do vider marks is avoided, and most of the tismal auxiliary lines are unaccessary

For most purposes the lines produced with the aid of the templet, if made with a sharp percel will be sufficiently good without any further work, but ever where it is desired to sharpen up the drawing or to trace it in tak, the work will be greatly facilitated by the even beight and spacing of the threads.



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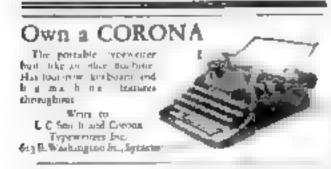
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- will start you on the road to success. See Money Making Opportunities on pages 120 to 143.

Too Big for a Lathe

(Contrayed from page L2)

expression was distinctly pained. He bad caded Old B B out for service in Lime of need and what did be bear nonsense!

"I know," Old Bill replied evenly
"I noticed the lathes as we passed through the shop. I saw some other things, too-for instance, your miling macline, a couple of hig boxes from some old engine, and a motor, and a speed changing outfit

The null foreman brightened, "Per haps you can do it here after all, he conceded in a more conclustory tone. "I hoped when we called for you that you would be able to figure out some kand of trick."

"I see what he is up to," exclaimed Lamons, "He is going to support the shaft in those bearings, and fix a tool to turn the journals.

"We add to we think of that before" the mall foreman ejaculated. Web. Old Bill has the reputation around here for der sang ingenious methods, and I suppose we should not hope to equal lumb!

They were still walking about one of the highlings. Ohi Bill, who had noticed some boards in the center of the concrete floor pounted to them und asked. What is under there? "

Nothing now" the mill foreman replied. There used to be a ecoveror or a trench through this burning but now it is nothing but a covered pet-

T IS the very thing I have been I looking for | Old Bill assured bill. There is the lathe where we will true up the shaft

"The wheel will swing in the pit?" Lamons asked much interested.

"Yes. Old Bid replied "We will fix up these howes so that they will carry the weight of the shaft and wheel. We will try to set them so that they are on some part of the shaft that is not worn

"That will be all right on one end. Lamons commented, "but on the other there is nothing but the journal

Perhaps the pournal on that end will be true enough to herp some. Old 11.11 answered. In case it is not, we will carry it on the centers.

The centers' Lamons quered Then, quick to perceive Old Bill's thoughts, he added, "Oh, we will take the tailstocks from the lathes and bolt them to the lloogs 1

Old Bill gazed quazzeally at the machinist, "You have it exactly, he ad-mitted, "They will serve to take up all the end play and then we may need them to carry the weight when turning the shart end of the shaft "

"The speed reducer you mentioned Lamons went on I suppose we will use that to reduce from the motor, putting a belt over the big wheel?"

' Just so," Old Bill replied. "Then, we must have something to hold a tool and I thought the best thing we could take would be the table from the miling machine. We can bolt the saddle to the floor, line up the table travel with the shaft, and clamp a turning tool to the top of the table. The feed will have to (Continued on page 112) be by hand, for

Pacing Your Strides Toward Super-Machines

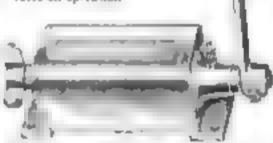
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\$25 IN PRIZES See Cash Prize Offer on Page 120

Too Big for a Lathe

(Bloomson) from page 111)

there is no use in trying to get a power

feed for so short a job.

The mul foreman was beginning to absorb some of the spirit which animated Lamons, and he set off to get more men. When they arrived, Old Bill gave a few directions as to how to proceed and said, "I am going back to town now. Your men here have the sies well in mind, and will get it carried out, I am muc. I will come out tomorrow morning to see bow they are getting

With that he went out to his car. feeling glad that he had come across a man who was capable of carrying out, yes, even anticipating, his thought.

The following morning be was on the job early. There were holes drilled in the floor. Some men had stayed all night to put them in. The muchine parts were near by, and the boxes prepared.

"You wanted to pour the boxes against the shuft?" the machinist asked. "Certainly," Old Bill replied. "I acc

you have the old metal out of them." "The drive is just about fixed up, too," Lamons informed him. "I have figured the pulleys to rup the shaft about forty feet a munute."

OLD BILL lingered a while, then went to the office to talk to the owners. He was interested to see how well the milt erew would get along with-out his guidance. They progressed very neety, for a couple of bours later a man came in to say that the outfit was ready

So Old Bill returned to the mill and saw the wheel in motion. He noticed that it can perfectly true, which showed that the shaft was not bent. The machinist was adjusting the centers.

When he had the wheel revolving to suit him, Lamons stopped the shaft and again checked the abgoment of the milling machine table. This he did by adjusting the tool at one end of the journal until his feeler gage would just fit in between the unworn part of the shaft and the point of the tool. Then he zan the tool to the other end of the journal and tried the feeler between the tool and the unworn portion at that end. It fitted just as well, which showed Lamons that the journal be was about to turn would be straight. Then be began the turning.

He was careful not to take off more than was necessary, and be gave purticular attention to the boning of the tool in order to produce a smooth surface without having to file the bearing excessively.

The long end of the shaft was turned first. The milling machine table then was moved and lined up with the journal on the other end of the shaft. Here it was necessary to tunites up the centers so that they took the weight of the wheel, The box was left in place to catch the shaft abould anything happen to the centers. That made it desirable to fit a scraper to keep the chips from being dragged down into the babbitt with the possibility that the finished surface

would be scratched during the turning.

Old Bill looked on at the proceedings, giving a suggestion when called for, and, after a time, when the second journal was being turned, decided that he would go back to town.

"There is nothing else that I can do," he remarked. "About all I have done for you is to look up your own material so that you could do your job. I shall have to think a while for a name for this sort of service!"

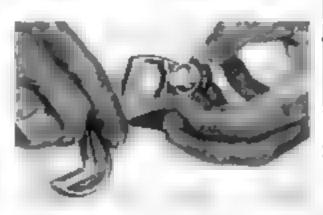
"We have not been disappointed," the mill foreman assured him beartily "We did not know how to get going,

and you showed us."

"Well, that's really about what I do in my own alsop," Old Bill returned. "There are two essentials to getting week out: the planning in advance, and the actual doing. I suppose that, after all, it is rurely one man can do both. My field seems to be the planning.

He drove back to town, pleased alike at the success of his scheme and the thought that mooner or later he might be able to add one exceedingly competrat mechanic—Lamons by usue—to his own shop forces.

Assembling Pipe Wrench with Aid of Paper Wad



Now crumpled poper in leserted in a pipe wrench nut to hold the surt guards in place

N ASSEMBLING the type of pipe wrench shown in the illustration, it is difficult to hold the nut in the frame, and at the same time keep the nut guards in place. A trick to make the guards behave is to put a wad of paper between them in the not. When the jaw enters the nut, the wad of paper is pushed out.

Rubber Band Acte as "Keeper" for Set of Steel Numbers

SWALL steel -mun parquak bers on metal are easily lost. To hold them in the usuai wooden case, merely stretch a rubber band around the protruding ends, as shown.-FRANK W BENT-LEY, JE.



Penches are held in place by rubber band

BEFORE being babbitted, east fron bearrags should be heated to about \$50 deg. F.



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Fact to build and rell this mounts bend constatuent and and or a constatuent of the state of the dans, some, of ors, coaps and other thongs that amusik of the sea.

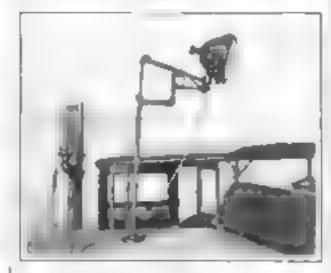
SEA ARTS GUILD

405-N ELEVENTH AVE. MILWAI EEE, WIS.

Controlling Searchlight from Motor Boat Cabin

MOTOR heat searchlight! can be A controlled in rainy or cold weather without opening the pilot bouse window, if it is mounted as shown.

The standard is a piece of 1 in 1919: 5 ft long with a T fitting at the upper end. A 10-m. length of pipe, an elsow and another piece 8 in long are added. and the light is clamped to the latter. A



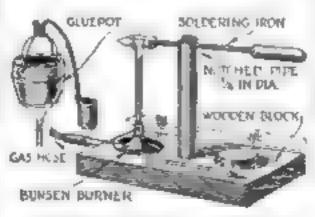
From within the pilot house this best ecurchingly can be pointed in any diffiction

7 ft length of tem pipe ross upward through the I in, pipe and is connected to the hald as not cated. As the hosp itself base a ball-and socket connection on its clamps, it is possible to form it to port. or storocard by means of the 1 in paper which is heavily taped inside the eat is to form a convenient grip. The bytapipe is pushed up or pulled down to control the vertical movements of the lamp. - CARATON GROUT

Small Soldering and Glue Kit

COUDERING from and gluepot are Indischold essentials. To keep them rendy for instant service. I make use of the stand illustrated.

The pape that apports the soldering from or gluepot is screwed tightly into a hole in the center of the wooden base



A convenient and merpenave stand for a Hussen burner, midering cross and gluepot

block. When the gluepot is to be used, a stiff wire, which is bent into a book at one end, is thrust down to the bottom of the pape. The gluepol is the smallest commercial size, but is large enough for ordinary purposes -- B. A. CHAMBERIAN

To MAKE a paint and varnish remover, mix 32 lb. metted paraffin wax, 1 gal. beaxol, 34 gal, methyl arctone and 12 gal, denatured alcohol. Star thuroughly



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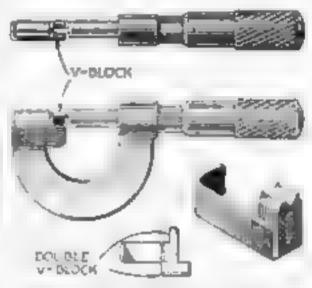
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A. & Jan Harsha & gant of Man well be surprised. Promises Equal Company, 6th M Signer, Malyone Bigulands, Macanimetts.

V-Rest on Micrometer Holds Small Work

HOLDING small, slender work in a piece is so short and at the same time so tion that there is not more enough for the throub and forefinger between the anviland the spinite. If such work has to be measured continually, as when the prodnot of a serew maximing has to be cherked. the task becomes one that is more than mere's difficult at becomes nerve tack ing. The V rest idustrated was designed for just such cases and will be found to sampuly the examining of such parts,

Il is I tile device consists of a small Vblock with a sheet metal clip attached to it and designed to align the Y-block just under and ahead of the anvil. The bent



Micrometer with V block in place, detail of the fisture, and an alternative design

end of the clip is formed so as to adapt it to the outer surface of the micrometer frame. The V block is notched out on the anvil side so that, when it touches the under edge of the unvil, the work will be near the top, where it can be easily placed. The surface of the lower part of the 1. block wireli comes in contact with the frame, is beveled off so as to form an angle of about 80 seg. to the clip, so that once the dexice is poshed on at wikistay. n place. It is construct an also makes the V-cost automat early self-nughing

The clip and black car becomes tea by soldering or with small rivers or serens. The V block may be made double as shown in the small diagram, then merely by reversing it a larger or smaller V may be brought into operation.

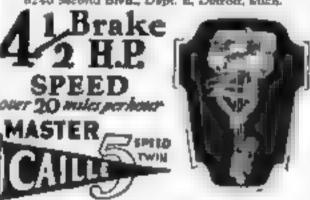
Any good tool should be hardened whenever possible and it will pay to make both parts out of tools teef and heat treat them, drawing the cho to a blue and the block to a light yellow .- H. S

WIRE solder is useful in the shop for make. mg patterns of irregularly shaped objects. In doing ornamental ironwork, for example. I do my experimenting with a sength of wire solder instead of making a drawing. When I bit open a satisfactory design, the solder is laid on a skeet of detail paper and the shape is traced then the strip is straightened out and la don the stock to mark the length of iron it is necessary to cut off for making that partiemar part T M HRIDGES.

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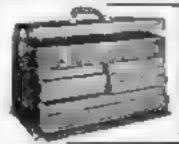
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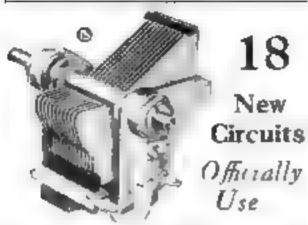
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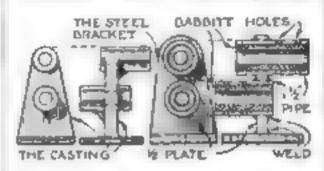
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light No. 61988

Owner, My Commission Capture March 20, 1939

Welded Steel Bracket Replaces Casting

IN AN industrial plant well away from shops and foundines there was a duplex steam pump to feed the boders. piece of pipe fell on it one day and diattered the valve gear bracket so hadly that it was even beyond welding.

This did not stump the ingenious plant. mechanic. He found two powers of pipeand two pieces of half-inch plate and welded them together to make a part like



The original easing is shown at the left and the built up resided brucket at the right

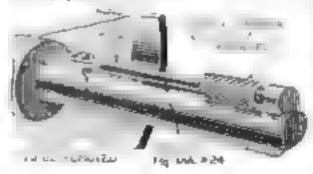
the broken casting. Then he drilled a number of holes through the pipes to ar shor habbitt. Each of the papes was bleel with bubbitt and when cold the me al was expanded into the juper by barring there's

To all intents be had a rough casting now. It was a sumple matter to law off the peressary links and then drid them The has soft formed a wearing surface as good as the cast from of the original, and the steel was amply stiff

Tool with Sliding Hammer Removes Gib Head Keys

IB bend keys are much easier to re-I move than those without heads, providest one is able to drive against the head. However, when the key is in it websel pulley or gear, there is no opportunity to drive them out in the usual

To take care of such conditions we made the key pulier illustrated. At one end of



A powerful key remover for gib head keys that cannot be driven out easily by sledging

a bur an eve was forged that would fit over the gib head, while at the other end was a solid head. Suching between on the body of the bar was a piece of shafting that served as a hammer. With the eye booked over the head, the hammer was slid back and forth over the bar, striking the solid head, and quickly pulling out the key.—Anton Zupancic, Jr.

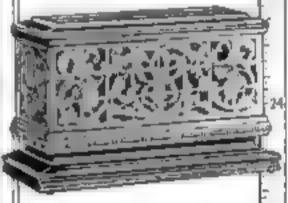
Type, prents and reamers can be reduced in size from 005 to 401 in, by immersing there in a solution of pitric and suiphiaric acids. The amount of reduction depends upon the time they are left in the bath.

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··· concealed in a cabinet only 18 long

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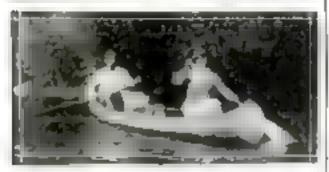
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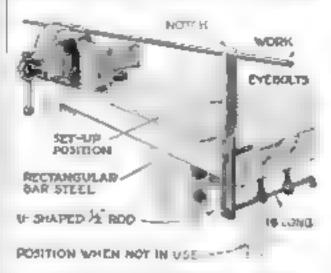
Old Town Canoes

A 2c STAMP -will start you on the road to success. See Money Making Opportunities on pages 120 to 143.

Auxiliary Support for Work Held in Vise

WHEN there is a long piece of work to be held in a vise, the machinist sometimes piles up baxes, pulleys, or any thing at hand to support the end of it.

The accompanying illustration shows a support for such work that is always



How the support, which disappears under the benelt when not in one, standars a long rod

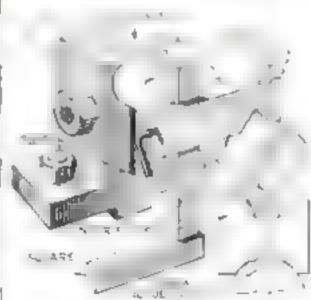
handy when wanted, but never in the way. It is arranged to swing down when not in use. The bar with the notel, at its upper end is made of \$, by 2 in, flat stock twisted as shown. Two holes are drilled in it for the U-shaped 14-in rod. One end of the bent rud rests on the top of the beach when the support is in the rused position and effectively locks it in place

The dotted lines show the support when lowered and pushed out of the way under the bench. - H MOORE.

Gulde for Centering **Key-Seat Cutters**

By G. A. LUERS

SETTING a key-senting cutter above the center of a shaft is tedious when the alogf) is some odd diameter, and both. ersome if the cutter is covered with oil, so



A V-block for centering key-senting cutters accurately, and a fixture for holding shafts

a number of machinists make a practice of guesong at the location and letting it go at that. If they have not guessed well enough, the key seat will be off center and will not match perfectly with the key weat in the hub. The key cannot be well fitted in such a case, and or likely to cause troutse, especially where the neive runs first one way and then the otler

To obviate this trouble and at the same. time to expedite the work, one enterprising machinist made up a double \ like that shown in the accompanying clustration. This V was made to fit the blade of his try-square, and in use was rested on the shaft. Then the entter was lined up with the upper V. By this procolure he was sure that the will by cut exwas directly above the center of the shaft. and that he would have an accurate kieg seart.

The illustration also shows a fixture for hosting shafts for keysenting that is a departure from the uson, custom. It has been found more satisfactory than Vblocks, particularly where there are a number of alufts of the same size to be keyweated, as in machine building plants. It is made of cast from with a hole hored to receive the shaft. A tongue on the bottom fits the T slot in the nating machine table. Bolts are provided to secure the block to the table, and there is another bolt to clamp the shaft being keyseated. The spring of the custing releases the shaft when the clamp bolt is

The clamp can be made for any size shaft, and it is possible to have split bushings to adapt it for use with smaller

Bending Tongs and Spring Clamps for Tin Shop

TWO sample devices are idustrated that have proved extremely nuclei in a Denver (m. shap.

The first is a pair of recet heater's torgawith wide news. These are 4-16, strips of by two land from ground to an edge from the outer aides and welded on each jaw of



Rivet bester's totals with wide laws welded to these for bending the least of spring clamps.

the tongs. The tool is lumly for bending light sheet metal.

The other is a clamp that may be shipped our salv over sheets of metal, clothespro-fast or proming them firmly to the work bench. A set of these is under of spring steel, about 6 in, long and 35 m. thack. The one shown on top of the bench Bustrates the shape —Joseph C. Coyer.

Cutting Pulley Oil Grooves

NSTEAD of chapping oil grooves in pulleys or bushings, they can be cut by putting a properly shaped tool in a boring tool holder and working the lattic carriage back and forth by hand while the pulley ta stationary

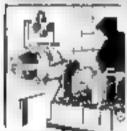




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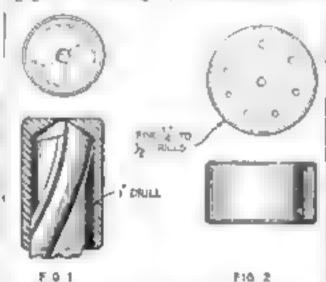
JOB-108 Spring Fired

Simple Center Gage for Drill Points

IN SHARPENING drills, the key to the situation is to keep the point central and of proper width. A drill with a correctly formed, central point is rarely out in any other way breame such a point is difficult to produce except by correct grinding. On the other hand, no drid will do good work or stand up as it should if the point is off center to any appreciable extent.

The importance of this is recognized by every good mechans, and various methods are in use to find out when the point is central and if not how much if is out. There is the simple way of measuring both cutting edges with a scale, but that is too from desome when it has to be repeated many types, and besides is good only for the larger drills, tinges based upon this idea are convenient, but sometimes fail when med on slender drills which have become algority spring.

By means of the very sample type of gage shown in Fig. 1, the location of the



The gages are made single for large drifts (Fig. 1 and multiple for small dride (Fig. 2)

point and its deviation in any way is established infability in a moment a time This gage consists of a steel or bries cuphored out to the size of the dell it is to test. A bole slightly larger than the width of the dall point is formed in the end The agode of the cup is counterbored at an meladed angle of about 125 deg., so as to bring the point of the deill always in contact with the bottom of the small hole. The end of the cup should be faced off to leave a wall thickness of from in in for larger drills to also it ... in for smaller ones. The inspection end of the gage should be blackened or bland so that the beg it dell point will show up plainly

All that is necessary to examine the point is to paish the drill into the gage and look at the end. There is no need to revolve the drill, as any error will be metantly visible.

For smaller drills, say under \$4 m., combination gages accommodating from three to fifteen drills can be made as shown in Fig. 2 from a piece of 14, in. round stock, so that the entire range of mass from A to 1/4 in . can be accommodated on three or four small plates. The length of the gage should be not less than twice the diameter of the largest drill it is to test. It is not practical to make gages for drills smaller than 🚠 in.

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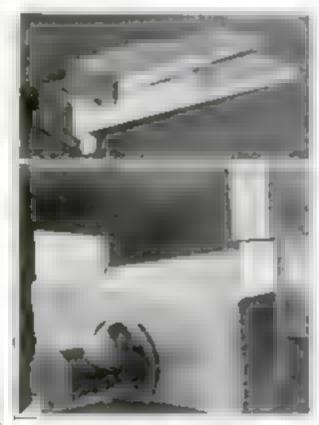


Compensating Blocks for Wooden Bench Vise

By CHARLES M. MILLER

BENCHES in many home workshops and in the majority of manual training shops are fitted with wonden vises of either Die eabinetmaker's or earnenter's type. When a tourst is clamped at one end of a wooden vise, the paw usually is twisted out of parallel with the beach top. This is had aliae for the vise and for the work and in time the vise may split and become so loose that it will not operate satisfactorily

By insecting a block of the same thickness as the work in the apposite end of the vise the strain becomes equalized. It is a simple enough matter to keep on hand



A set of two vier compensating blocks of the built-up type, and a one parcy block in use

antable blocks of the more common thick present of dresoud boards. Still more convenient are the blocks shown above

Blocks such as those in the upper illustration will serve most purposes. One is made of a piece 36 by 2 by 81/2 in a piece 1, by 2 by 4 ¼ to and a strip 👍 by 14 by 8 in the other consists of a proces by 11 ha 814 ma, in proces by by 13 to 4 2 m, and a strip 36 by 31 by

The reason the cleat for the second block is made 2 2 m. long is an that the early will project enough to prevent the block from slid ng down through the visc when it is used eagewise to compensate for work 1% in The k

Another type of banck made of solid stock is shown in the lower distration. It has a projecting screw to prevent slipping when the thickest aection is in use.

Redwood for Ship Model Making

FOR making blocks and deadeyes for this protein, I have found that redwood is easily worked and does not split teadily Strips out from an old Isquare were utilized for this purpose in my own case. The wood is of such a color that no variash or paint is necessary, E. A. D'ARMER.

We Pay for Ingenious Shop Short Cuts

WHENEVER you work out some way of doing a job that is a little quicker or easier than usual, remember that you can, perhaps, turn the idea into cash by scoding it to the Better Shop Methods Department of Pupillar Science Monthly, 230 Fourth Avenue, New York You will be helping other mechangs by passing on your laborsaving "kinks," and at the same time may earn some extra money.

Make a rough sketch to show what you have accomplished and write out a brief description You may write with pencil, if you wish; it's the idea that counts, not the form. Have a photograph taken, if possible, showing just how you did the work or what the tool, fixture, machine or product looks like

If your suggestion is one that can be published in this department, a check will be sent you promptly, the amount depending upon the originality and utility of the idea rather than the length of the description

Cleaning Device Keeps Shafting Polished

EVERY mechanic takes pride in a sloop took to clean and free from rubbis. He bkes to have but toom on Lis workbeach where or daily use or in the fool box if needed on all few occusions.

While keeping the stop clean, do not forget the shalting above. In a week a

resource. the shalt will gather a great deal of flying dust or shavings. This dirt can be removed easily if the shafting is cleaned once a week say every Saturday morning.

A rest of wood ofconvenient length serves on the handle of the

MATERIAL SHAFT LONG POLE

The riesner hooked over the hop shaft

device. This strip should come within a few feet of the floor when in use. At the top end is united a short block shaped as shown on the maide edge to fit over the shaft. Strips of abrasive are fastened to the inside of the block.

The device is hooked over the shaft and a weight fastened to the end of the pole. Thus putts with sufficient force to wipe off all the dust and tarnish. After one section is cleaned, move the cleaner to the opposite ade of the next pulley to clean and polish a new part of the shaft. —H E. WENRICH.

What do You have to say

when you are with interesting people?

Can you hold up your end in a general conversation—or are you tongue-tied when with people?

CAPTER the weather has been discussed and exhausted it is only the well informed man-the good talker -who can hold the attention and interest of his friends.

Everybodyenvies a good talker. You know from experience the big advantage the man or woman has who is an easy, fluent talker. In every-day life men and women who have this personul advantage are popular-sought after. And in their trade, business or profession they are the ones that get to the top.

The valuable ability of being able to converse smoothly, naturally and with full confidence is based on have ing at your command a fund of knowledge that will be of interest to those you are talking to.



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we will pay on July 10th the following -

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First read every advertisement in the Money Making Opportunities Section on pages 120 to 143. Pick out the one that interests you most and then write a letter—not exceeding 170 words -telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on June 1st. The prize winners and their letters will be published in the August issue of POPULAR SCIENCE MONTHLY.

Address pour letter to Contest Editor MONEY MAKING OPPORTUNITIES

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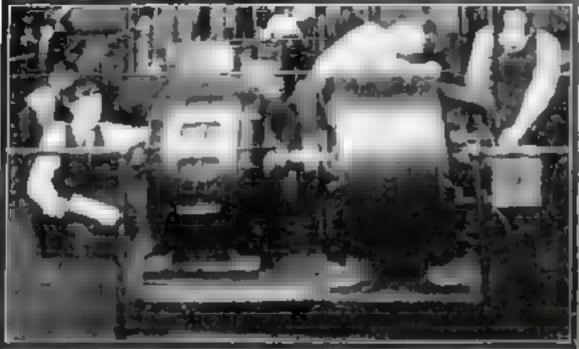
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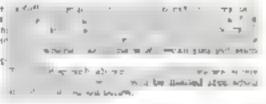
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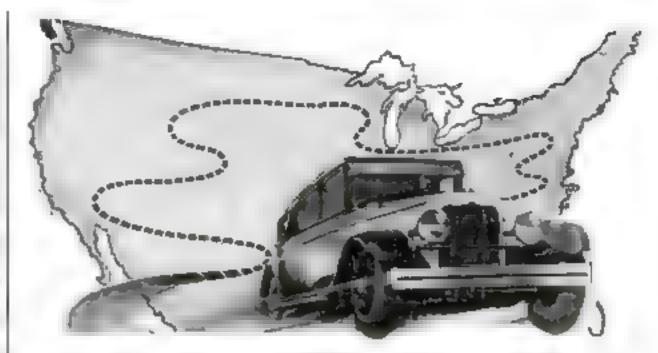
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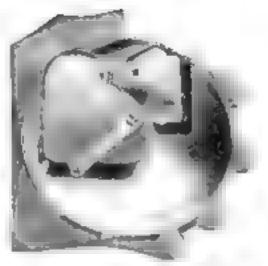
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Child's Desk Built into a Chair

A Space Saving Toy for Small Homes

By CHARLES A. KING

MILDREN enjoy drawing pic-C tures and "purying school" as they describe it. When they began to go to school they do cheerfully a surprising amount of home study It pays well, therefore, to provide a convenient desk for them. The one ithistrated is in the form of a combination desk and chair and is designed especially for use in an apartment or small house in which there is little room for a child's belongings.

When the seat is lifted, a blackboard made of S-ply wood is brought in view. Thus may be used in a nearly upright position or slanted like a deal There is also a rack for papers and drawmg books, which is concealed by the blackboard when in its apropht postion. In the lower part of the sent are various



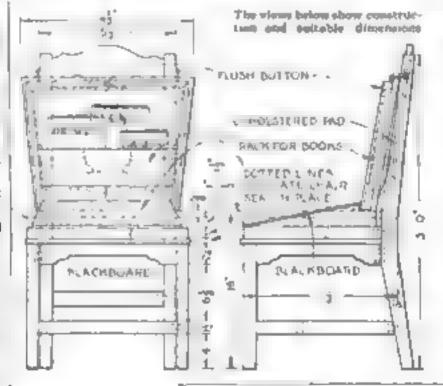
child who likes to draw compartments for writing

materials, games, and the

While the design calls for the chaping of the back rade and aplat, it may be symplified by making three rama as the back, these will be more comfortable if given a horizontal curve of about 1 uich. Hooks are placed at the top to my the seat when it is moved

The chair may be made of oak, ash, red breh or other strong wood and the seat upbalstered will a felt filed pad after the finedring has been done

The desk compartment obviously can be fitted into an old chair of suitable design and solidity at a consafernide saving of work



Parrot Feathers Decorate Unique Serving Tray

BRILLEANT, colorful "feather mo-A saic" forms the striking decoration of the serving tray illustrated. It can be disposated by anyone who has a parrot or is able to obtain a variety of bright hued feathers.

In this case the feathers were moulted

by a small yellowheaded Mexican tord When a sufficient supply had been obtained, the prywood back was removed from a mahogany serving tray and covered with a thm sheet of light gray cardboard. which was fastened with tray flathearled tacks at the

corners. The feathers were roughly assorted by their general tuits and then arranged on the cardboard The carefuly elemned glass was lowered

on the feathers and the frame was put in position. A thin blade was slipped beneath the backing and the whole tray

raised carefully and laid face down over a box so that the randles could not touch the table. The back was fastened in place and covered with slightly damp wrapping paper w hie b stretched as tight as a drombead when it had been glacd. by its edges to the frame of the truy CHARLES M DOTEN



A gurgeously colored "feather mosais." The central feathers are blue black, given and red, the others are gray, ecariet, yellow and white



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"He said my face was more or less familiar and he remembered assing me pante until the L C S. wrote has that George Jackson had suraffed for a course of home study and was doing

fine work, "'Who's Courge Jackson?' he asked.

"Who's George Jackson?" be asked. Then he booked me up. Told me he was gled to see I was ambitious. In he'd keep his syn on me.
"He did too, Gave me my chance when Frank Jordan was tent not up the road. I was premoted ever older men who had been with the firm for years. "My spare-time studying helped me to get that job and to keep it after I get it. It certainly was a lucky day for me when I signed that I. C. 5. coupen,"

me when I signed that I. C. 5. coupen.

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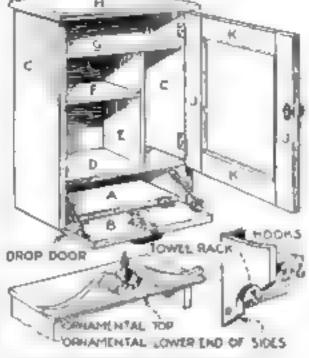
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Wall Cabinet Has Handy Shaving Shelf

By H. A. BAILEY

WEMEN -and boys too- who make things for our home generally get less use out of such articles than do the other members of the bousehold. Here's a project, however, that will please every one. It is a bathroom medicine cabinet with a special shaving outfit compartment that has a drop-door shelf. Thus door gives ready access to the abaving



Shouling articles on the lowest shelf can be reached without optiming the mirror door

articles without interfering with the use of the narror in the large door above it

The interior of the calunct is arranged for packages and buttles of various surts BIN BERTH.

No trouble will be encountered in building the cabinet if the sides, top, bottom and shelves are cut accumilely to the sizes indicated in the accompanying tall of materials.

Dadoes (grooves) are cut in the sides C ⅓ in, deep to take the abelyes D and G. The dadoes are stopped 1 in, from where the front edges of the shelver are to come and the shelves themselves are potched out to suit. The shelf F also is housed is in deep in side C. The index, top and bottom are rabbeted 14 by 14 m. to re-

ceive the back. which may be wallhourd, plywood or any thin material.

The marror door should be so made that the space rabbeted out for the mirror wall be 1114 by 1474 m., although the glass steelf will be slightly smaller than this. The door may be made with mortise and tenon joints or doweled together.



A medicine enhinet of magazil marty

or even constructed with initered corners such as are used in an ordinary picture

The side pieces may be extended for some distance below the bottom shelf, if it is desired to ornament the cabinet. and a curve sawed out either with a coping naw or a band may, if one is available. This extension makes it possible to add a towel har and toothbrush hooks. The top also may be ornamented in some such way as suggested at the bottom of the accompanying drawing.

As the calmet is intended to be finished either with two coats of flat white point and one or two coats of winte enamel, or two coats of shellac and two or three coats of white brushing lacques it is possible to use any close grained worst such as poplar, white pine or whitewood.

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Your Home Workshop Problems Solved by Experts

FEW questions that arise in connection with your home workshop or such repair jobs as you do about the house have not been fully answered in past source of POPULAR SCIENCE MONTHLY. If you had a complete file of the magniture, properly indexed, you would have an encyclopedia of extraordinary completeness.

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Transferring Pictures on Glass and Porcelain

BY ERNEST BADE

PRINTED pictures on paper may be transferred to glass for the purpose of making transparencies or even lantern shaes. First thorougely clean the glass and cover it thinly with dammar variously or Canada balsain that ned with turpen time so that it flows freely. Bet the glass

aside until the varushed aurface becomer tacky,

The paper in maked thoroughly in water and then pressed on the tacky varnub with the picture facing the glass and dried with blotting paper. The paper may be removed.



The print is stuck in place with remish

by rubbing it ensefully with a wet finger. The gasss will retain the picture on its varnished surface.

By similar methods prints may be transferred to metal or porcelain. A variash known as French variash is used this consists of gain sammer, alcohol and Venge or againsed turpentine. One teaspoonful of gain sammer is desolved in about 4 or, of alcohol and 4 teaspoons of against 4 or, of alcohol and 4 teaspoons of against 4 or, of alcohol and 4 teaspoons of against 4 or, of alcohol and 4 teaspoons of against 4 or, of alcohol and 4 teaspoons of against 4 or, of alcohol and 4 teaspoons of against 4 or, of alcohol and 4 teaspoons of against 4 or a real of

The material apon which the print is to be transferred a covered thickly with that variash and when the surface is tacky, the back of the paper a most ened, the printed aide lightly covered with the variants, and the print firmly pressed in place. Not less than twenty-four hours later the paper is most ened with water and the fibers are rubbed off

Under these combitions the print will be reversed. Should it be necessary to transfer the polare as originally printed at may be accomplished by incorporating an extra step, in the process.

Monten the back of the paper, varman the picture aide quite thickly and let it dry. Fasten a clean about of paper to a drawing board and cover it with one or two layers of engienter's glue. When both papers are any, the variabled surface, which contains the picture to be fransferred, is also coated with glue and pressed upon the prepared paper.

At soon as the glue has hardened sufficiently, the back of the paper contouring the pattern at a stened with dilute hydrochloric hard, which is absorted by the fiber. With the aid of a little water, the surface is rubbed gonly with a finger to remove the paper. Since the glue is softened by water, the paper must be permitted to dry so that the lower surface will not be destroyed. Then the process may be repeated,

When all of the fibers have been removed, the picture is again visible. It must be varietied, pressed firmly upon the metal or porcelain background, and permitted to dry for twenty four boors. Finally the paper is socked in water and removed. Should any glue remain on the picture, it may be was ed off.

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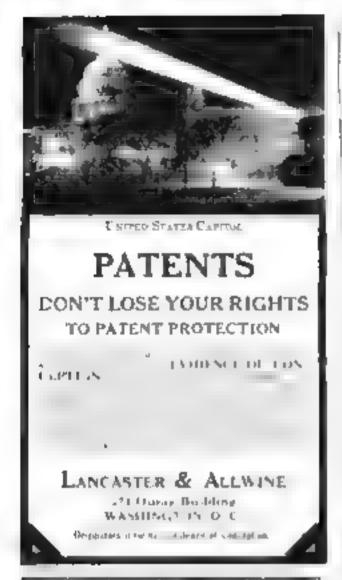
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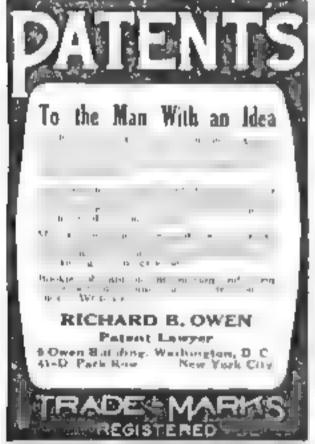
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Television At Last!

(Continued from page 13)

by the cooperation of experts in the Bell Labbratories under the direction of Dr. Herbert
B. Ives. Besides planning the research and
designing much of the apparatus. Dr. Ives was
largely responsible for the development of the
photo-electric cell to its present stage. The
method of scanning the face or scene by a
beam of intense light, as well as the development of special forms of the neon lamp, were
the contributions of Dr. Frank Gray, while
the apparatus for synchronizing the two ends
of the television system was worked out
junity by H. M. Stoller and E. R. Morton

Their scheme, wonderful on it is, still is far from perfection. Many problems remain to be solved before it can be given to the public. For one thing, the pictures at present are meapable of being "thrown up" on a large-screen. Observers at the first demonstration found that while the images, as viewed on the amost screen were clear enough, in the larger screen they appearest durred and sary. Before tailin scenes and faces can be displayed on a full-size motion picture screen, we are told. 300,000 optical fragments in at he transcreted every second, anates I of the 900 as at present

A COTHER of ficulty is the fact that television amount be used on a larger screenin a motion picture house, for example—withlat throwing a far more powerful light on the face to be transmitted. Even the light most now is strong enough to cause disconsfort to the "actor." The development of a more sensitive photo-electric cell, experts my will be one way of overcoming this deficulty To facilitate further research and improvements, the newly organized Federal Radio Commission has set aside a special experimental wave band in the upper part of the present amateur band (between 149.9 and 199.9 meters) exclusively for television experiments

An official of the American Telephone and Telegraph Company is authority for the prediction that the first commercial use of television probably will be the broadcasting of boxing matches. For this, he said, the present apparatus would require few changes, while other concerns are used will prepositate considerable in provement. An open are sing contest at right is said to be particularly adapted to the lighting requirements of trans-

A CITIER early development the same offices predactors, probable with be the establishment of televation stations in the larger value, some are to the "telephoto stations now operating in a discussive. There are person wont be able to see any talk with a distant friend face to face.

Whatever like test user may be, this much seems evident: The coming possibilities of televation bardly can be overstated. We manot begin to guess the wonders it houds, any more than the originators of motor particles result forecast the acrees drama. As with radio televation will be with as almost before we are aware of it serving as as a vital occasion contributing to a thousand ways to our spuller and empsyment.

Magic Signs of Broadway

A WONDERI AND of colored flashing alle New Yorkers and visitors from all over the world with new and constantly changing signs. Magical effects of desting clouds, leaping flames and surging overa spray, are the product not only of master electricians and mechanics, but of artists as well.

For one advertising display, intended to portray a house on fire, a burning building was actually photographed. The picture was transferred in colors to a mich disk, in red and yellow for the flames and gray and black for the smoke Flames were thus drawn in along a complete circle traced on the disk, no that when the mich support was revolved in front of a projector, leaping tougues of fire appeared on the background which completed the effective scene

The name mich disk artifice is used to represent rain or snow. Spots of appropriate color are pointed on the disk, which is then rotated vertically before the projector less.

On a pirate brig sign advertising a motion picture show, a concealed electric are periodically causes a blinding flash that minutes the firing of a gun. The effect of ocean spray being thrown over the ship is achieved by the use of four stereoptican projectors.

Flowers That Change Their Sex

AVOCADO blossoms, the flowers that precede a crop of alligator pears, change their sex from morning to afternoon. This was the amazing discovery of Dr. A. B. Stout, of the New York Botani-

cal Garden, seeking a reason for barren orchards planted with alligator pears. He found that certain blossoms were male during the morning and female in the afternoon, and others vice versa.

Science Advances in Spiral

SCIENCE has developed in a sort of ascending spiral, according to De. J. Newton Friend, of London, England, lecturing before the Royal Institution Scientific history repeats itself. For instance, there of Alexandria, a Greek physician who lived about 100 B.C., resorded what is generally known as the first steam engine. Later, after centuries of oblivion, the idea was resurrected and made practical. Democritics, another Greek, conceived an atomic theory of matter

Then science excled about to alchemy whose backhone was the transmitation of metals—principally of base metals to gold. By the time of Robert Boyle, highis physicist of the seventeenth contary, alchemy had fallen into a srepute. Now we have done another about-fair for the most learnest scientists of the pay are again investigating transmitation. But each time we circle oack to the same idea, we are on a higher level science has progressed upward in the intervening time.

Serino pevez, that mysterious listlessness that follows on winter's heels, may be due to a lack of vitamines in winter foods, says a Bertish scientist. Sunlight and green vegetables are scarcer in winter, and the deficiency, he mays, leaves the body an easy prey to disease germs and minor adments.

Black Death

(Continued from page 18)

"See how we feel, captain." said the machinut gramly "Guesa well al stay he glanued at DeFrees "unless the ductor wants

"Of course I do!" burst DePrees. Plainly be would not desert his creation even in the face of death. He turned to the commander.

"I can trust you to let me go," he mid, half

questioningly "You can," reposed Drake. "That is, if she will let up.

Like a scake the wretched man wormed his tong body through the doorway of his "Detachasic Turret" Drake closed the watertight shield after him. In dead allence the crew watched the curious performance. Presently a small poot light by Drake's hand blinked. He threw over the releasing lever.

Helond the bulkhead sounded a thump, fullowed by the whish-h-h of arrushing water

Involuntarily the men growden forward. For some of them the moment of becore determination to stick by Dricke and passed. Now they auw the last strew of hope snatched away hefore their eyes. Was a possible that Drake was wrong and the civilian right? How could they pulge. One of them grouned aloud.

Drake still stood before the operating lever Only a few seconds had passed, though it seemed poors since he had made the move that a oudd have sent the inventor harting toward the surface. Suddenly, with a cry, he wrenched

the operating lever back into place. "It didn't let got" he pasted. "The man's

Securing holts were replaced. The turnet's door was opened. Into the X-5 rushed more gallous of water

Drake leaved through and sexed the http: shoulders of Debrees and massed on out. The many with his face we went tout at all companies.

One of the sastors prought his hammock, imlasting it as he came. "Here, explain, lay how He placed the hedding on a tool locker raised shove the sevel of the deck about which slowed peveral mehen of water.

DeFreen allowed houself to be stretched out. Then feebly he runed hamself on one elbow. Team entered down has cheeke. "1-Laupnose I was wrong the said. He stretched a supplicating hand toward Drake. must save us, commander. Only you can do at." He want buck.

THE huddled men awayed like sheep toward Their command agofficer Consternation at the fadure of Dr. DeFrees, vanuated device gave way to helpless panie. They were trapped The frightfurness of it all purelysed their farmities. The awful choking of gas victims sensed one after mouther

Now, if ever, Drake most show his lenderalup. Their only hope by in somebow enlaring the aid of the Folcon just above them.

If only he could get one end of the submarine up, the men muchl cut their way out. That had seen done on the S-51. But that boat a pumpe worked. The A-Je pumps now had collapsed. Moreover, the vast weight of water in her bow anchored her heavily to the bottom.

A closen wild ideas flashed through his brain. But none congenied to practical form. He grawed his firt and inwardly curred his lack of magnation From tone to time DeFrees grouped and baobled feversh demands for Drake to save him. One man sank southing in the deck Another fainted. If only they could be set to work!

Suddenly Drake clapped his hand on Har-

board's shoulder

"I ve got it" he shouted. "There's still a WAY OHL

The men crowded about him eagerly "Here a the idea. Before we left the yard I crawled over the X-5 (Continued in Juge 192)

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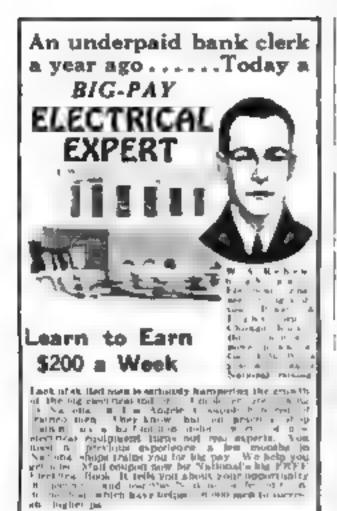
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Black Death

(Continued from page 131)

from end to end. I noticed that they douly recently put in new engines. They lowered the cylinder sections down through the much hatch and worked them aft through both threathings bulkbends. If we can unbolt the engine sections and shall them forward that change of weight ought to let the I S rise on her note and stick her old stern right out of water

A muffed cheer met the suggestion. One would have thought that Druke had announced the boat a arrival on the surface Instead, as both he and Harboard knew his plan was but a final desperate move, of which the chances for success were sucrearant.

But with a blind faith in Drake all felt that the plan would work nonchow. They even talked of the surprise those about the Fakou would feel when the X- Z_F none midded above the sea.

TO HASTEN the work Drake divided has even into two gamps. These gamps spelled one another every two hours. In the cholong lumes every gauscular effort was painful Slowly the men weakened. But a their brake hanter none adoutted that defeat was possible.

The hours fragger in Section after section of the sun's sing outto at stored ragger was disconnected and dragged forward by house force. Slowly the X-5 was tilting upward.

Twenty-odd fearful bours passed. Branes grew much and muscles would scarcely respond. But the promocra struggled on

Suddenly the whole main deck hove gatelity upward as though lifted by an univers hand. And at moderals excess light went out. All hands a most at unbies, against the bulk reach forward of bein. A conditionated as me of the engine are toom broke home and convened towards the A. a none. A stiffed grown betravel a poor fe towards all riched by the main.

Note up, bogs!" pelled Drake.

His hand flashlight out the taky blackness. Sore enough, the submarine stood almost vertically. Her athwartships bulkheads had become her decks

At Deske a direction the chief mard most crawled upward, topping with his business as he went

There are no content the chart.

Her hammer had breated the water the The commander a pure had worked the Varie state projected above the author.

becomes afform allowed. Drake know that change of tron might open men means. He must cut a hole and signal the Follow for a one before the 1 - rank union.

Only a hand deli was accorded. The strongest men were assigned to 1 fee manutes at a stretch. It ask grasped the first delice to prece the skin of the hout, as a jet of fresh rold our struck his sweating face. The next scattant he ground. Look'

DRAKE equinted through the field. There indices, was the outer world at not. But what a world. A stormwest was ldack sky and angry waves with acusel og fog masses driving before the wind.

The Falcon was nowhere in night.

It was the end. Possibly for a few hours the A 5 might stand in an upright position. It would take lays for doing men with the wanty tools available to dr for a hole lag enough to crawl through. And even if they did not drawn or sufficiate in the meantime, they could not live in the tempest outside.

Let even now the communiter would unt

Bring a rod, chief, "he called; "one of those bottom anonching roda. And let me have a short. We'll just above a agent fing up through that hole of ours."

And, not to appear to have surrendered.

Drake kept those mes who count still stand at work drilling away at the steel plating. A woodperfeet might as well have tract to pierre Stone Mountain. And all the while the X-2 impreceptibly but surely settled back toward her level. By midnight but few mehes free-board existed between the tray went and the sea level. I were sea that brine through it upon the slavering weetches with a

Showly the stern settled. An hour more at the cent hand the A r would damppear forever. In the tempest there was no claims the fusion coursever tool the spot again. It is get take many months of deagging a formet the hour. By that time she would be full of sail land transmitted.

With these grain than glots in his griggs in caland a prayer upon his upo. Drawe preced again

thet his gaze

BCT suddenly, out of the blackness came a ghostly glow that lighted the storm-t med see. Drake rubbed his eyes, Was it the vision of a brain discedered by the terment of the hours just pant? De was help really at hand?

Extrage tin little aperture. Only blackness

The locker again. That tend is saw a bridgest shall of and. It were the tenne of a water said. If the same moment came a long stattering.

"The Fulcou's back! She's found on

screamed Drake and full exhausted

The rescue was a feat worthy of mention in the annals of the are. Oil from the Falcon flattened the unity combern. She maneuvered to windward and made a lee. Perdocally for whalebook worked down upon the X-5's annuing atom.

Her chief engineer led the rescue party that crawled out upon the wave-swept black mont. Drenched and stavering, he and his me ear from it a small dark of steel. With his own grarted hands be somet the half-dead seamen from the r times, one is one. Last of all his fingers gripped those of Courmander Drake.

Five munites later the A-5 gave a great gulp

and mank out of sight forever

to the sheltered waters of Hampton Boads the Falcon anchored for disembarkation of the Secret Committee and of the narrivors of the 3. Behind closed doors in her small wantroom the Secretary of the Navy gathered his party before he left for Washington.

then there is a take it as the consensus of opinion that a detachable cylinder may be all tight in theory, but in practice is probably bound to weaken the inherent strength of the

There was no describing vince. De De-Frees, looking di and shaken, did not rune fair

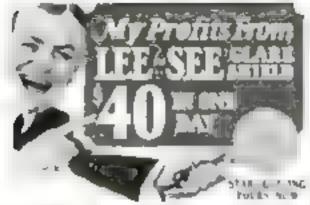
THE Secretary turned to Drake: "It gives me great pleasure, communder, to tell you that I shall arge the President and Congress to appropriate for a submirroe based exactly on your plan. In emergency her man engages or less torpedo tubes can be detached from their formulations and shifted forward or aft. A manhole will be placed in her extreme how and at his atern. As you have pointed out, this is the simplest and most effective mode of escape for the even of a sunker submarine.

"Thank you, sir," and Drake, beauing Dr DeFrees ruse and stood unsteadily. In a low word be naked. "May I say a word, Mr be related."

Certainly

solumning.

"Then I is the in add that the housery and devotion to duty of the mounter Drake most certainly ought to be recognised by the Government. Holding out his hand, the inventor turned to the officer be had dealt with so contracted agly the day before. "I want to shake the hand of a real man, he exclaimed.



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Bare Hands

(Continued from page 4.7)

The result was a very heavy and sturdy shaft. New for metal bearings," and Thornton. It was not sample, but by welding a square piere of metal to the end of his shaft, he managed, after a whole day's work, to hore a hole in it, in which the shaft would fit, once the bored arction was cut off. Another day mw him make the second bearing, and a third my the completion of the lathe, with metal bearings and shaft

The only trouble with this power plant," be mid, "in that one can't take of anything more than a filing or the belt will slip. Still,

it works."

They made a forge by the simile expedient of tarming a pair of sedows from the furnary around and leading the air through the bottom of promation coast aroug min or net of a chargonal her negacit to bent their metal Then they fushment man needed tooks tongs chiecks. a crude plane made from the ha test wood that they could find and with the blade held in place by a wedge, a mult grindstone that helly laboriously chapped out of a layer of sandations and mountal on the end of the shaft that turned the lathe unother are a better adae, two sensy hammers, and a depenlook for prior the lathe. Someone was functor hamsberring on the arrival making from it that Also at last their equipment was sufferent to warrant I a r beginning combraction of the beat and empire

WHITIAM's remarked Thornton at breakfost, "we'll have to divide up again on this work. You and helly work on the bont, and I'll start on the engine. It a the only was to get the job done within a reunoual s short time. More of us could work at the boat, but I don't see how all of an could gurn grack by working on the engine, for it has to be made a present a terre-

Bight," replied Williams. "Let a go."

It was a week before the keel of the heat was set up, and the stem and sternpost were erected, but the job was well done and sturds The ways were placed beside the stream where it widened out after emerging from the ravine at the foot of the cliff. A small sand bar lax across the mouth of the stream, but it served as a breakwater and could be dup through after the book was more sed. From source unt I dark every due the party fabored, and mirely the least 1 ok shape. The was a mosthed whalelent, with the stern cut off square. Her box was high and her sheer was marked. She was broad and deep and sturdy. Planks for her sides had to be cut laborously with the adser out of trees that had been split in half one plank to each half tree. When they were finished they were heavy and thick, and only with the greatest difficult count they be made fast. Still, after many days of heavy work, she was planted

N THE meantime Thornton had been hiller. rag streamounly at the country. It took him days to make the patterns for the base and for the cylinder, but once these were completed, the wooden shapes were duplicated in metal within three hours-with Oomak and Kelly beloing at the blast furnace. In the first attempt the cylinder, when dog out of the mixed and and rlay that had been carefully prepared for carting, was found to contain a huge hubble in the inside wall where it could not possible be turned out. So the centrag had to be done over aguin. At hist, though, a smooth custing stood. hearde the well-formed base, and Thornton could turn his attention to other things.

"What reversing link are you going to see" asked Williams one day when he had gone to Thorston's assistance at the auxil, while the peston head was being made.

"None at all," replied Thornton. "It's hard enough to make the (Continued of page 141)

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Bare Hands

I ontinued from page 133,

thing go me was. It doesn't need to back up.

I wonder west on Wilhams, if it wouldn't be better for me to help you. Kelly east do a lot on the hout alone, but you need help on this engine. If fell you You and I had better work on the engine and when we get it made we can both help keep

We'd probably save time," agreed Thorntoo, and thus it was that the naval architect turned his attention to the forge and latter But he naturally needed much direction and assistance from Thorston.

What abould I start on?" he asked:

"Why, turn out the made of the evaluder 1 guesa," suggested Thorston.

"Do you suppose I can manage it?

I don't see why not. The lathe is a let rickety and the tooks are crude, of course. But if you are esteful you can do it.

Hat the latter want swong 1. Williams

her fated. "The easting a too tag

I had planned to mount the tool in place of the chuck," explained Thorston. "I fixed a place where the cylinder can slide back and forth along the frame of the lathe, and the tool can turn around. I'll help you get started."

WiTH a slot and a wedge Thornton fas-tened has best tool in place of the chuck, and by slicting the heavy cylinder lines, and forth along the hed of the lathe Williams managed to get it turned out. Finishing it was equally difficult, but at hat the custing was ready to take off. Persons went all of meday rubbing donor the made walls with fine seed for seed with roll and approved with warper of ricalat skin.

fill a about the rulet and exhaust values? asked We almo a few slays later. That will

be a stringer word at?

No replies Thorston "While you were working on the lathe I made some pretty good renment. That a why I said a cotacy valve would be better than a shiling one

Once more the big cylinder was put buck on the lathe, and before dark a conical bule, that had been cost in an awkward lump of metay on the inde of the cylinder, was reamed apple to the store

That a changle for your " remarked Thoriston. "When we make the valve we'll groud it

in by hand

Days of work for both of them followed on anythand to see the automost was forgot and turned. The jucking but through which it powerl. In the bottom of the exampler was mode ly placing half a dozen metal pina in the bottom of the piete to bold a washer with a bole n the center for the piston rod, and boles around the outside for the pros. The rod was thrust through the washer and through the bottom of the cylinder, strips from their paysmas write wrapped tightly about the shaft between the washer and the plate, and finally, the prin were riveted tightly down upon the washer, foreing the strips of cloth still more tightly against the rod

THE peston followed, and a groove was cut about it and filled with strips of cloth as the packing box had been. The bottom plate of the cylinder was bored for rivets, holes were horsel diagonally from each end of the evlipder wall onto the consent hole that had been cast and reamed in the huma of metal on the side of the cylinder, and the cylinder was set up.

Thornton undertook the task of making the crank shaft, building it up in five poeces thest the three bearings, which were hand forged and turned down on the lathe. The ends of these were made agoure, and to order to build up the shaft, two heavy koks of steel were forged with aguare holes in each end. The aquared cada of the main bearings were thrust through these

equare boles and welded in place, while the contacting rod hearing was welded at the other end of the links. When the crunk shaft was completed and Thornton set about testing &, he found that one box was too short, throwing off the line of the shaft. Repairing the trouble was a delicate task for he had to heat the center of one loss sections anyeing his curefull, mode to an egy and then on the and L had to beat the link out until it just out hed its brother. A flywheel was east with a square hole in the center for the shaft, and was turned down and size II hadapted on the lather

Who do you want a powheel on a steam ringine maked We are a

Because our mist and exhaust valves are not going to be absolutely perfect," Thornton explaned, "and I want the thaft to get past the center before the steam comes in and stops the machine, or makes it back up in ente of or Anyway, the machine an't bulamed at all, and a flywheel will help.

O flywheel a flunge was built, to serve the N THE and of the crutik ideals apposite the double purpose of a thrust block, to press against the heavy base of the engine when the push of the propeller was to be taken up and to make the creak shaft fast to the propeller. fluide.

The objects had progressed to their point by the time hells completed for planking of the heat. Thereton and Welliams at 1 and to pulse the hearings. The connecting end, the immedculve that was to seeve as the reset are extenset. port, and had, furthermore to assemble the may have with receta and passe.

Thorston had bearned something of how to make bearings when he load built the once for the little. Now he list nots? - copocite that tank, except that he wanted three materal of two and he wanted them cal into two parts. This he accomplished by bacong his bose in a rectangular piece of cetal test be welded to the lathe shuft. One contention of the rectangle was a full inch greater that the dusteter of the hole by horse. But the other dimensoon was harrily a quarter of an tuch more Thus, on two rades of thus bared-out back, the hole came to within an eighth of an inch of the outside surface of the metal. Along the outside of these than sections he cut carefully with a cold chosel and fundly had his first bearing in two parts. He ground down the is ugle edges on the greadstone and littled them over the shaft. Two more aunifar hearings had to be made, and he apent pearly two weeks on the three. Williams, in the meantime, managed to make the holts and mas that would be needed, and forged the connecting not as well.

THEY set the machine up. The bearings were riveted in place between the base of the machine and metal caps that fitted above the shaft. The connecting rod hearing was siratlarly riveted in place, between the lower end of the rod and a cap of metal that fitted around the bearing. The amehane was crude but it was as simple as a machine could be made, and as they turned the flywheel they reached the conclusion that, lavishly coled, it would serve their purpose

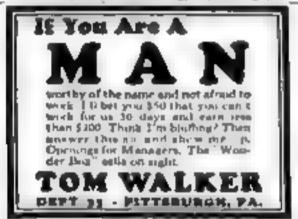
Only the valve remained to be made

"Why did you decide on a cone valve?" asked Wilhams, who had managed to restroin his clation after observing the result of their long weeks of work as it stood between the lathe and the forge. "Wouldn't a slide valve have been better?

"No doubt," replied Thornton. "But we can't make a perfectly true flat surface, such as a slide valve requires. And we can make a pretty true curved surface. The inside of that contest opening is (Continued on page 168)



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Bare Hands

(Customed Suppose 154)

abready pretty amouth. When I have turned that come down a bit, we'll grind it in by hand, and so we'll get it to fit. In the come I have made inlet and exhaust passages. By turning the come first one way and then the other we'll change the inlet port from one of those holes you have hored to the other, and at the same time we'll transfer the exhaust port. It will be sample, and the way we have I regged up, the pressure of the steam will tend to press the cone more tigatly into place all the time.

He was working on the cone as he spoke. It had been forged to hand, and had a flat place up one safe running for half its length from the thoir east to the modite. On the other aids there was modifier flat place that run from the maidle to the thick end. Thorse too had mounted it on the lathe and was engaged in lutting it down. He look it out and treed it from time to time in the hole at was meant to bill, and mailly engaged Winnama.

THERE it is, old score be said. "All it needs in a in the ground around in there for two or three bours to said, a life at lie said and on. Here. I have journed this said up are: strained it through a piece of cloth a couple of times. It is it just naturally have to do for rivery journey.

Now only the losters remained to be made before the power plant could be assembled

and the host bronchest.

The fittle cost stood starble as the major, decided fore and all. A substique, between the two bears buildingels, was the space for engine and budget. Forward the deck was raised to provide for a cubin with four bunks. Aft a lower deck covered a galley and a ment room—ting but complete with neath and a table very rough a built at the last openent. Votage made of cast may stood on a stall covered by a stone beld in place to wedges, and a charge major force beld in place to wedges, and a charge major of cast room had through the sleek.

The engine weithed months enough, and attends. It stood here feet ugb perhaps, and rested on a brusts must have. The exhibiter had a strange protointance on one inde and in it the cone subscientiance on one inde and in it should from the anall end of the valve until it should out over the flywheel, and there it was lend at right angles. A hearing supported it may where it was bent and a hour end connected the end of the prin, which wrived to ruck the rone subsciences and forth, with a pin that it sek out of the flywheel two or three inches less the center of the shaft.

But standing as it was at was no more than no much mortises metal, for an yet there were no boilers in which to generate the steam to drive it, and the four men felt for more like resting than turning their attention to making book is and rivets.

THE task that faced them was far more monotoned than what they had been doing. They did not dare make a single large for two reasons. In the first place of a range broker should give way it would leave them without power. Then, too small broken would be stronger than a large one, and they could generate steam with less danger.

But they can't be unwining more than forcels, remarked Thornton. "They will be lard enough to build that way, without any feels. So we'll make them three feet in diameter and four feet long—perfectly simple—and we'll have to hammer out the plates by hand and rivet them by hand. Thank goodness we can have the holes on the lathe."

"Flore about rivets?" asked Williams.
"You'll need an awful lot, won't you?"

Thornton started

"Twe figured it out," he replied. "Twenty seven gives to a plate—farty plates to each bader—twenty-neven (Continued as page 156)



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Bare Hands

fautenmed from page 1 at

times forty is one thousand and eights. Then the code each will take one bundled and twenty-two. That makes thirteen bundled and twenty-four rivets for each budge may twenty-term bundled for the two

twist night' exclaimed Williams. "It will take a year

Not quite," laughed Thornton, "You and helly tackle that while Oomak and I make the plates. That a no cinch in itself

Williams and helly, having first cost small anvils for themselves with a V-shaped notel in each one, began pounding out rivets. Day after day they hested late of metal and pounded streamously

THORN TON meanwhile was averaging the bear strage haraner and though was loading the red but metal with two poors of heavy tongs. Ingot after regot was posteded into a plate. Plate after paste was gradually added to the pile brook the units.

The time came at last when the reset makers had completed from task but still more plates had to be made. So Williams and had furned their attentions to the artis, and larger boring lastes through the plates. Thus it was that when Chornt in and Oumak finally moupleted their terrific task, after nearly a mouth of steads work a pile of plates say bored and made to be reveted.

First small sheets were rivered together to make one large sheet four feet trade and ten feet long. This was benten into a curve and the ends rivered together. All tay the picked the redshot rivers from the force throat them through the postes, and charled them with heavy blows.

Next they made the ends, and hammeted the round sheets they had fastened together, into shallow pant, with the edges turned up an each or so all the way ground. Holes were bored through these upturned edges, and corresponding holes were bored through the ends of the boders. Finally one cod was fastened upto each basier, and Disentes last out the various openings that had to be cut in each one. One opening was for the strum pape leading to the engine. A second was for the safety valve, and a to of for the water gage. This was a four on the end of a steel rod, which was hept at right angles. Marks were made with a cold chart on the end of the boder where the gage was mounted, showing what the float would indicate when the water was pumped in

A SIMPLE hand pump was made to force the water against the steam pressure, the other end of the boiler was put on and riveted in place, and the first boiler, crude and awkward and heavy though it was, stood complete. The task had seemed endless, but now the end was approaching and they took up the job of finishing the last boiler with thankfulness.

They had been wreeked on that formken island when oping was lartily more than half gone, and they had lived there through the spring and all the summer. Now September was upon them. Their beards were long and their hands were calloosed. Their mutcles were hard and their faces tanged.

Plat their tasks were sinspier now. One of the prescript ones was the casting of paper. Dues usual west three arctions each righteen packer long, one T with places in it for two spaget throttles, and three elbows. They made the patterns very largely on the lathe, and cast them all at once. They exceed the paper together by means of the flanges with which each section was fitted, and set about testing the business.

Their safety valves were unaple, control plugar realing an about resocut cant steel paper that atous up two or three rection from the tops of the basiers. He weighing Thurston on a tentace made of a mask tree placed over a sharp tock, they got a pile of ingots exactly his weight, which they still estimated at one hundred and morty pounds. These were divided into three equal piles, each of about acty-three pounds, two of which were melted down and fastesed to the rods projecting upward from the angety valves. The bottoms of these plags were circles one square much in area. Therefore, if the steam pressure came to exceed sixty-three pounds, or thereadouts, the valves, theoretically at any rate, would ruse, and the excess pressure would be released.

But they had no idea what pressure the horiers might hold, so they put water in them, built first under them, and retired to a safe distance, huping that the "pop valves" would work in time to keep the horiers from exploding. Time after time they had to draw the time a coder to tighten some leaky seem, and what they had to one that would would be a tank that would consume part of a day turned into a cherr that consumed half a week. At most though, the sound wore light, and the population lifted, permitting long plannes of steam to escape before they settled down once more. The trul was a success, and they were published. Their agest job was to install the machinery.

IN CELEBRATION of the completion of this final task before the markinery was located into the hoat, Ournak prepared such a feast sale had bever before attempted. He had may wondered how he angest prepare the dired bears that broke Joe had left, and at fast he humelf became an inventor. Passing the furnace one day be speed I mention a casting indic, and immediately select it. He had had no pot, and Mentione had not been be had found a way to bake his beans.

The meal was a joyous one. The men sat about the table and talked of home and thoughts eat, of regaretter and decent elether, of aspirit pavements and elevators. Show they would make their had for freedom and home again. The light from the fireplace threw lickering shadows about the cave, and outside the open door the dark night settled down black and still. The casting ladle, in which the beam had been served, by empty on the table, with its long handle projecting over the end toward where Comak stood before the fire, still preparing fish and invide.

That of getting the machinery into the hoat "ICE conversation turned to the next job-Oomak had just deposited another fish on the table, and turned about to put a stick of wood on the fire, when he started back with a cr. of terror. This based fell upon the bumble of the halle where it projected be and the end of the table, and the others may the Dong mying suddenly through the air. It clanged against the top of the open door, then fell with a doll thud upon a figure that stood in the dark just outside. There was a cry. A body fell to the ground. A hand reached through the door and lay with its tingers outstretched in the firelight The hand elemented, a group cause from the dark beyond the door

The men about the table leaped to their feet, uparting the benches on which they had been sitting. They may the long, black hair of a summan failing over a face that it conscaled a face that has bende the arm that reached from the notwice darkness across their threshold to the edge of the flickering feelight.

A woman on this lonely island! Who is she, and how has she come there? Can she, perchance, explain that dreadful cry, or solve other mysteries of Devil Island? Another great installment in next month's issue.

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What It Costs to Build

(Continued from page 69)

8-m.; with helper

Stadding rafters, mong hourd DESCRIPTION. 300 ft B. M. (a) " " " Floor posts Place board horsemtal sheatleing wall or 500 (t. B. M. $\Gamma = p \uparrow$

Diagona, matched sheathing 500 "

In siding and in matched or tongueand groove sheatling the square feet of stringe actually covered in about one quarter less than the board measure area given. To find how many stude the carpenter places according to the above havres, apply the rule for board measure M ratiply length in feet by tluckness and width in melies, then divide product by twelve. Thus for a stud 2 by 4 by 12 (12 ft long), most ply latter by two and by four wouch equals 90, dividing 96 by 1 *equals 8 1 boxed measure. Now do ide the corpenter's dualy start of 400 ft. B. M. by B. and we find that he sets up all all ide of the stated size in a day,

To resume the later tunctable

Il ming word slungles, 700 to 1 000

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Placing window or door frames in I to 6 Import BASSORY. Next frames, fittished with term 4 frames Deserts fittes), harriwate a igilarit 6 kmm leade stars with balestrade के बोटा क Flooring top or tracked floor had

dire og. ft. Parsting in table wal the court 180 aq. ft. Pay hing, inside one cont-1 10 mg ft Papering room [36] say a day

Tune estimates for other work:

Steam best one-pipe circuit with helper; per mehater. R's class Hot water heat, with helper, per radiator. Tto T days.

Plandage with helper per fixture the charge papers; I fort men Electrical work, with believe, metal cubic, electric outlets per day 4 to 6

Planning costs six to eight percent of the total bouse value. Heating is about the same if steam or hot water, but two percent will cover a warm are one-pipe equipment. Wring a house with metal. cuble costs usually. Direc to four percent,

The labor in a job of enepentry was estimated at forty percent of material cost a dozen years ago. Sonce then noterials have gone up about twice. wile labor has advanced in some localities three times. Therefore in three localities inday labor and material cost in wood construction are even.

Here are some useful figures for total and a restrict or better them better the force of the land

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province for the		53
Resting wood skingle, per 100 op. ft.	22	50
La hand plant it thus runte shit on Vid		Oa

While in building there is saturaction th getting value for your money, economy should not be an end in itself. The cost of a good job will be forgotten in its endaring comfort, but the tramph of undue economy is short lived.



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Secrets of "Cold Light"

(Continued from page 2.)

lighting plants. He has found this effection even for such a low form of lummons life. to be at least twice as great as that of the average electric lighting plant, in which only one half of one percent of the energy of coal intract as for 16 converted into light

Lunsinous bacteria sometimes grow on animak, causing the latter to appear huminous. Sand flem thus inferted share brightly in the seaweed. Certain fisher home the factoria The most remarkable as a deep-sea fish called Photoblephason, or "light eyelid," discovered in the depths of the Bunda Sen. Dutch East Indeed. The Photod-liphoron forms in query partnership with anemonopic light givers, providing them with board and ledging in return for illumination. The lactern are supported just henceth the eye, where they form an ever-burning lantern.

As a means of shorting off the light, the fish has developed a curtain of skin, resembling an eyelid, which it can draw over the luminous spot. It uses this queer lamp as effectively as lummous fishes that supply their own light.

VEN branau beings occasionally exhibited E which the mine met of luminosity. Sametimes, before modern medicine and surgery, wounds became infected with luminosis bar teem which enused them to give at night

And then Mes. Christine Ladd Frank in of Columbia University, recently advanced tefore the American Option! Somety the theory that himan perves emit light, much as do the tamps of the firefly and glouwors. Mrs. Lade brunklin clayer that mider certain conditions a network of highl can be seen to seignate from the nerves oming the back of the eyeball, aggreering as an illuminated terre made the eye. It is probable, the ungests

that all our nerves have this hundrous nower Doctor Harvey and others have revealed the process by which living light is produced The raw materials are oxygen and water. The power plant" which produces the light contains a luminous secretion which can be arparated usto two distinct parts. One of these, called luciferus, communes oxygen to produce the light. The other, known as inciferage, is a cutalyst, or transforming substance, which speeds the process. The cuset chemical nature of lucdersn and lucderage remains a mystery,

though the former is believed to be a protein.

while the latter is related to the alloum us.

THE amazing thing about locilerin as a light maker is that it never seems to burn When you hurn coal or oil as fuel, it combines with oxygen and vanishes as god. But when bucderin combines with oxygen it becomen a luminous substance, cu led over incifering which is not lort, but returns again. to inciferin when the light goes out. Then it is ready to be lighted again.

This is what happens when the firefly flashes its light on and off. It is somewhat as if you had an electric fluid light, whose battery would renew itself after every flush and continue to renew itself indefinite a

it is an extraordinary process," and like to Harvey. "The economy of it is evision! I a already possible to devise a lang is which brederin is burned continuously over and over agon, To be sure, the light it were but the principle of operation remains. Per apa we tour book to an application of the trace as for development of new means of ill to our one

buch development involving the manifest ture of artificial anderes would map a the world with the ideal light, and at less out-

Forty-Niners of 1927

A outmard from page 2"

twenty-five years without showing anything but low grade ore. In fact, young Frank Hortop a father had last money tracing vene that yielded nothing better than \$12 a ton. Then, by chance, the boys found their fortune.

The wealth of the strike is described by First to bert a young desert prospector.

"I bridge open a count of rock about our snehes in dismeter," he tells, "and found the whole made plastered with free gold. Other housters disclosed the mane values. They were at least maty percent gold-

An Oakland, Calif., groupsper reporter told of seeing a magle handful of croshed rock yield two tablespoonfuls of gold when panned.

The lare of pold to as old as history. From the enricet civilizations pomesoon of gold loss meant power and wealth, and it has become the world standard by which the value of all things is measured. If represents concentrated later. In ancient times it was precious chiefly because it was the meest of known metals but not trains, Platinum, cobalt and makel are somere. Radium is priceless in comparison. Indeed, gold is an plentiful an copper, tin and lead. It can be found almost everywhere in rocks and soil, even in the ocean.

Y Al STRALIA men netually make a living by extracting gold from the waves, and amentists are weeking methods of taking the metal from the teas in better-priving quantities. Good in care merely in the sense that in few places is it found in quantities sufficiently concentrated to pay large rewards.

Men today print gold for its appearance, its hardiness, its uncludens. Its tach, yellow luster endures indefinitely. It weither custs nor tarnishes readily. The social stack, one of the elements of nature, is all but impershable,

It is proof against attacks of all ordinary orlds. Moreover, of all metals, gold can be worked most readily by craftispen. A spage graph can he leaten into a tion leaf fifty-six inches as sace, or occurs total a wire 500 feet long! led it is no strong that a golden wire only nexts five thosessort in of an and a thick can imposed the weight of a Late pointed main?

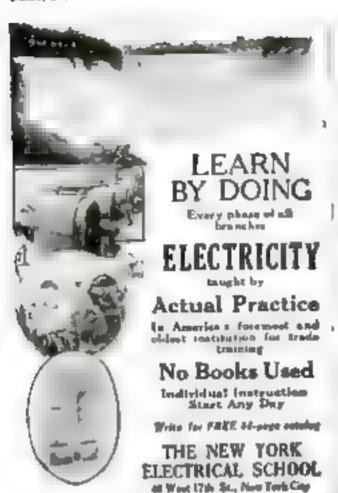
We often hear of pure gone well-few even have seen tank. Gold from the mores or never page of penting his gold and sever nonetimes with traces of iron and copper.

REFINING processes separate the other metals from the gold; but we carely use some gold, because it is too soft to withstand rough wear. All our come and ornaments are alloys of gold with copper or with copper and silver. United States come contain zine parta of gold to one of copper.

Jewelers measure the purity of gold by carata, or tweaty-fourth parts. Thus, pure goal is mad to be twenty-four carets fine. Most powelry is not more than eighteen curata fine

In the last 500 years, it is estimated, men lave mined more than 18,000 tons of gold. And they have hardly scratched the crust. Alchemests of old sprint their lives endeavoring to create gold from baser metals. Modern magicians of science, seeking the same goal, have reported success in changing mercury into gold, though not profitably.

Some day science, discovering new secrets of matter or delving into the earth or plumbing the mysteries of the sea, may make gold cheap as dirt and put an end forever to stampedes. Moanwhile, the glittering rock of Weepah makes men's bearts beat fast with exertement, and the rarest gamble in the world builds tented mining chaps overnight









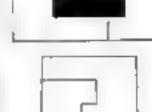
Answers to the Sam Loyd Puzzles on Page 67

The Tree Riddle

Translate t stanto Roman numerals, CL, and combine the letters with OAK, and you have CLOAK as the answer. You should have guessed that within five misutes.

Dividing the Applea

The full names of the four girls are Ann Jones, May Robinson, Jane Smith and hate Brown. Twelve minutes carns a high rating.



The Zulu Battle Fing

The diagrams show how the white part of the flag can he disserted into some play parts that 60 Logether as a square Twelve member gives a good rating.

The Behended Words

The believeded words are: Crave, crate fable cell hand born hash kee know. Tous should have been a ten-minute exercise.

An Etfish Equation

There are five to some or side and three on the other. Cancellation leaves two income rade. Phere are say gir winnings and, and I fee in the other Agreemen leaves there girts on one side balance gagenest the two-boxs. Therefore, a giran weight in two thirds that of a new hight hove on one side of the wexaw therefore. ye. Id requite twelve gath on the other to effect a palance. Five mounter is good tone.

Counting the Votes

The loss of 11 votes to the apparent wante g new manue a hillerman of the to toland I Repence 42 was equal to me more than one I ad of the a morety on the first count. Therefore 21 would equal a third, and 63 must have been the number of those scated. The standing vote being one third greater must have been 84 The total number of voters was 147 The property and the problem.

How the Sixters Shopped

Martin and bertrude started out with 809. Mortine pand 68 30 for her but. No 30 for her sho w. Gertrude peul 28.50 for a blaues & 50 Or set parasol. Har Martha benght a 46 pair of store and bertrude a 29 blome, they would cave each spent \$14.00. Ten promier is good

Answers to Tests, Page 34

Terms of Applied Science

1 Armature 2 Flament 3 Carburets " or a Ammeter 3.- Bessenier converter 6 I rhane " A vanometer 8 Acyro-dubisper 9.-Hadronetroly 10.-Pasteursation

Inventors and Inventions

Walt, 1700 2 More. 0837 3 Ed-Bon 1833 4.- Newton, 1687 5. Westingbouse, 1949; 6 Roemer 1675 7 K pler, 1669; 8 Howe, 1843; 9 McCarmies, 1854 10. Hell. 1876 11 —Gat aug. 1861 12 Califeo, 1600

Mental Measuring Stick

1 \$280 2 2204 6: 1 440: 4 -43,560 7 37 , 6 4 2 -6,090 S. (Kindelig g ... 6,000,000,000,000, 10.—231, 11.—6; 12.—600

Application of Measurements

1 25,000, 2 1 100: 3 - 256: 4, 239,000: 5 439 4 6 - 29 5 7 196,000; 8 -6,000; 000,000,000,000,000,000, 9.—93,000,000; **1**0 59; 11.-09.5; 12 -29.141



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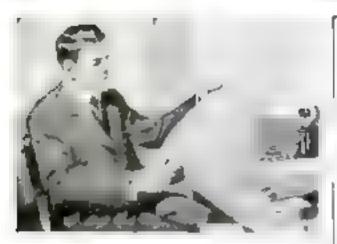
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City Populations Predicted

Continued from page "

population of approximately 17,2000,000, this planet can support 8,000,000,000 persons -more than four times as many as there are now. At present, only twenty-eight percent of the world population is in the tropics.

Europe and Assa today support nearly four fifths of all the world's inhabitants; in another three hundred years, Professor Peack astateatrs, the Europe and Asia total will have increased another half billion-and still be only a quarter of the world's whole population. North America, he believes, will eventually aupport 600,000,000 people some 200,000,000 in the United States, the billance in Canada, Aaska, Metico and Central America. He believes that Austra in will have eventually a total population of something like four hundred ene tifty trailing. But the deasest population we exist near the equal in the given Brazilla future population of 1,200,000,000.

IN THE John Hopkins' estimates, the shift from rural to ushon population is siginficant. It is possible, from them, to enleulate what the great cities of the country will grow to be, lifty or a hundred years from now. Even though the total population of the United States will apparently increase little more than fifty percent in the next seventyfive years, many of the larger cities will double. even treble, their present population. Taking the "law of growth" as a basis, it is possible to work out an estimate of what the leading esties of the country today will grow to be by the end of the century. Here are figures, based on their early "growth curves," of ten extres and their probable populations at the end of the century.

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Chiralte	2.10 105	410 00
Petropt	499 di X	4 4 48
Land Superiors	n 6 J	4.1 88
1'bu sale phoa	1 Au D	3 7 44
Plan merre	7.61 526	1.72 84
St. Leans	31, 417	L LEITHE
deserrate	245 154	1.4 6000
Parant set	31 - 2	1 1 188
Anni France most	50 PH F T 6	1,71 470
Presburgh	386,343	\$443,460
49.4	1	

Of course, these are only rough approximations, dependent on the theory that conditions of growth will remain comparatively unchanged. At any time new conditions may

mean starting out on a new hasts—as Detroit and Los Angeles have already done. Also, with such figures as that for San Francisco, so account is taken of pergliboring cities the Oakland and Berkeley aroun the bay, Alameda and San Raphael. Together they may form an imposing group, rivaling anything else on the Pacific Coast. In the same way, Seattle and Tacoina may form part of a great Puget Sound unst

N THE South conditions are already changing so rapelly that it impossible to my what tomorrow will bring. Furt Worth or Houston may be jumping forward in anoffser ten years in a way that will make even the phenomenal growth of the last decade erem merely a beginning. New Orleans, or Atlanta, may see the start of a boom that will equal the recent Florida excitement. And no one knows what Florida cities will do-

But the great metropolis will continue to be New York. Dr. Prarl and one of his associates, Prof. Lowell J. Reed, have culcumten the New York figures in full. In spate of the fact that the lower cast aide holds already the most densely populated dutriet in the world, with 219,256 people living to a total area of less than three quarters of a single square merthey est mate that the growth of New York wal continue until the present population has proce than doubles!

The population of New York City, on July 18, 1925, was 6, a05,384. By 1986, Professors Pearl and Brest entrante, it was be 7,002,000. But that is only for the metropoiding on rich theif In the autorium over that is fed by New York as a center the 1930 figure in 11 430,000. By 2000 A.D., the figure for the total area will be 28,705,000, and for the city district alone 13,948,000.

Think what that means! Already, on one corner, 40.000 people pass in a single hour. Crowding seems to have reached an absolute limit. What will the condition be fifty years from now, with the population doubled. How, in the year 2000 A.D., will that great New-York-area population of nearly \$9,000,000 be housed, transported, fed? The answers to those questions will be told in another article to appear in an early mine.

Wonderland of Science

Continued from page 14,

mission units." This did not satisfy the arientists. They wanted a more delicate test tion one in which a man listened to munda and guessed at their relative loudness. They had found out another interesting fact—that while the human car is not infall blo when it comes to comparing two sounds, it can always note even the alightest difference between them. Put two loudspeakers side by side, and the ear can tell when they sound able.

So they took a loudspeaker that was conceded by judgment alone to be a good one. They worked with it and adjusted it until the car could detect no change of volume when the jutch of the notes it responsed to changed suddenly. All sounds reached the ear with almost perfect uniformity. The secentists recorrect and tabusated any alight variations. They labeled at. "Standard Loudspeaker

Now whenever a loudspeaker is tested, they set it up alonguide the standard instrument and try them out together. Throughout the entire range of sounds, the new speakers peculiantee are charted.

No abstract tests, these; no applying of an arbitrary voltage in a set and measuring its response to some arbitrary electric current. Here, booked up to a full sized autema, the renerves actually received.

Graphic diagrams show what different makes of sets wal sound lates. Here is a curve that marts off cothumastically on the low notes, to trail away and on when it reaches the muldie of the chart. "That set behavice says, "gargles and belows—you can't unser-stand a word it mys." For speech is a matter of high frequencies. The best sets respond to the high-intelied times by which you recognise a friend's voice, not alone the lower notes that merely carry the "body of the sound

Another curve leaps up from the middle of the chart, rises to a dirry height, and then drops away as fast as it tree. Setat no setatelying and hisses will greet the most who turns on that set. Here is a curve with its peak at the high end. that promises to give a he hant high-patriest tone, a good quality for apeech, but no mellowness at all. It will leave out all the trass notes of an orchestral.

Clear across one chart undurates a curve in what is nearly a straight, horizontal line. "The set that made that curve. Senauke said, "is about as near perfect as youd hope to find. You can hardly sing a note, or but one on a musical instrument, that it won't respond to.

Strange curves—charts on paper from which, as he wantedry they are finding out things you want to know about toots and rading.



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How Sea Flying Was Made Safe

(Cantinged from page 53)

hanks grew thicker, the river truffic denser, watil the clamot of sureas penetrated even above the noise of his engine

Now the towering skylene of Manhattan came into view. He awing almost to the edge of the Paliandes, then straight to a landing field at the northern end of the island. While his assistants filled the gas tank, Curtim rushed to telephone the editor of the Wand

I have landed in New York City be announced, "but I am going on down to Governors Island.

New York's indions watched, unbelief changing to amazement among the throngs that janumed windows and roofs along the river front. Curios flew out of les way to carde La erty's torc - then Iropped to a perfeet labouing on tanvernors latend parisle ME HAIR!

One hundred and fifty-two miles he luid forwing in an actual time in the air of two limites. and fifty-one minutes, at an average speed of tifty-two miles an hour

General Frenchick Dent terms community officer at the Island, as he sensed the flores

PEOPLE at hist admitted that aviation for I "arrived." Fivers a crywhere were inspaced to seek new records for my travel. Charge Hamston flew from New York to Philadelphia and back on June 15th in a Cartiss. plane; the first round-true flight between two arge cities, wonning the prime offered by the Yes Fork Times. On the 4th of July Curtus al Attentic City won the \$5,000 prize for the first aviator to fly fifty moles over the ocean On the same day Walter Brooking in a Wright machine made a new world's aftitude record-6,000 feet. Then, on August 20th, Curtim made another world's record, the longest flight over open water, sixty-four miles over Lake Erje from Cleveland to Cedar Foont and back again, in a driving remotors

treation meets were held everywhere, the supriner of 1910. Exhibition flying at Shrepshead Day New York, in August, with five Curtisa fivers in the sig at open a marvelous spectacie. Here McLuisty of the old Aerial. Experiment Association, first demonstrated w reteso communication between a plane and the ground. Claude Grahame-White came from England with a Bleriot monoplane and at Soston heat Curtum by a nlight margin, And that was the end of Glean Curton air racing Just us as the old burgete dates he at opped purping when he was heaten at byracuse now he concluded to let the younger fellows, he pupils do the exhibition flying and racing white he devoted his time to developing the airplane. nventing improvements.

HE international challengers went after the Gordon Hennett cup again that summer. Curtiss had built a monoplane, but at the fast minute decided not to its in defence of his tropics. Eugene his competed in a furtise liquine. A. J. Drevel, Jr. was a constestant in an imported Bleriot. The Weignt brothers entered. So did Hazzilton. Alfred Leblanc, the French contestant, had probably the fastest machine, but crashed into a telegraph pole at Belmont Park, and Grahame-White, the Englishman, Bying a French mach. ne. took the International Cup back across the Atlantic.

Now the Army and Navy begun to get interested in flying. Congress made triding appropriations for fl. ng experiments- \$125,000 for the Army, \$25,000 for the Navy! Curtus offered to teach, without charge, all the Army and Navy officers whom their departments maght detail to learn to fly and, early in 1911, established the farmous (Continued on year 142)



the long tent for the point fulfillment within from their position deposits to the tent of the tent of the control of the cont take a thing that the long the latest three \$12 to \$100 p. so that a property of the property with man

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How Sea Flying Was Made Safe

from a compage Ist.

flying port at Sun Diego, with five pupils Now, besides getting the Army and Nave this the air Curtos nauted to Separateate has own earliest theory that flying over water could be made as safe and as practical as 0 ing over land. The New Fork World suggest of transportation to a sphare of a message from on the after deck of the Hamburg-Ame on liner Pennsylvania, from which McCurdy was In its back to New York from intente Sain's Hock But a careless mechanic selft an alcan on the partorm. Mit and a propeller struck of and was shartered and that first experiment proved noting. But the crosser It consighing was received at a similar part form, and on November 16, 18 at Empone (2) flew from ship to alare at Hampton Roads,

It seems communitare enough now, but the whole world gut excited over that feat . Now By from above to a monthly Navy and an Jamuars 18, 126 h gene his made a successby shore to stop flight, landing on the deck of the 1 S. S. Pennsylvania in Sun Penneticus harline.

A) San The sect of as and low mechanics. were has I hong po as that would foulresulting the postcour, until one da date in Januare, 191 4 stort on, 1919 of them out to see how it would behave on the

HAD no idea of going into the nie at that time, though I knew it was possible," he told me. "Nolvely had ever men from the sarface of the water. But this machine handled so beautifully that my action in elevating the plane was more undiretive than intentional One several I was skimmeter the surface of the hay and in another I found movelf in the air It more with a meldenness and case that mirproced me. I flow half a mile over land, turned and abplied on the water. Several naval rraft in the hay tooted their orena in applicate I rose again from the water. this time inlentionally, and again alighted. I had got what I was after

Not men could its an where. First the has breather hand been antequenced as with the sea-Only the am mone with needed to reduce the problem of world-wade flight to practical necomparation. Now the appliance could be from the share to according to beine the stap. to another aughting so the water and bing lifted about the the shap attackle and curt or times I present within a few days, when he to a sufficiency Proposition of max lifted with to plane to the lattice is a deck, man lowered again to the nater and flow light trialings.

"HAT was condler great assetting year That The Var longht two of the new s Impropriance. The Year Longhi four or five a retail. The first non-ever carried ! erplane was taken from Macola N. Y. 45 arden but I built Book with the Post master formeral of the United States at a pass singer. I class agents souted it rope and wouth America arising pages to beside, to Rossa to Bear. Then on December 5, 1914, the United States Patent Office granted the patent application of the Arnal Experiment between on, a mark on the inferen-

The Acts Class of America crowned a triimphast year for Curtee by awarding to him the Robert J. Collier trophy for the most suginficant advance in aviation during the year, and pearing to John Air Pilot & License No. 1.

But toleran Continuo wanted un acceptt which come float navigate the water is floing lead In November 1911 he made a secret trial of such a craft, and on January 10, 1912 the flying boat flex

Blank

Meantaine the injunction which the Wrights had obtained, restrain ug the mie of aircraft by the Curtous Company, had been denoived, though the putest litigation was by no means at an end. I stension after extension was made to the lotter and plane shops at Hammondstweet us. 4 the end of 1919, Curtim' company was furning out an airplane a day-

One question now was on everybody's "Who will be the first to fly sernas the Atlantie?" Rodman Wammaker merchant, quelignas and avation cothumest sectors on the factor blackages thing lead wat a speechalf around their land gone before and attanged with Lieut & C. ligite of the Hotsh Navy to undertake a trans thats that Work on that Hong less) the discrees, was begun in December, 1913. It was almost ready to Sy when, in August, 1914, bermany and Great Britain went to war. Licut, Porte was recalled for service and the America was bought by the British Covernment for submarine-detecting patrol duty

N THE meantime two honors had come to t atten which among all of his Eviation transity he cherishes most highly Piret. was the award to him, in May, 1914, by the Smill blooming first station of Washington of the Langley modal for activitioner a pound of pure gold, presented for services in the development of art field flight, and received from the hands of his propert gamerate. Prof. Vesatuler Graham Hell. The other was as we see tion by the Smillsonian Institution to prove that Prof Summer P Langley, the Institution a Carroons werestars had netually built a flying ame or that rought fly

Curtim took the old Langley aerodeome of 1908 from its resting place in the National Moseum, and shapped it to Haremondaport What kappened then in perhaps best told by the asserption on the placed set up in front of the machine, in the Minesina at Washington.

"In 1916," the macription reads, after deactiong Professor Langley's ill-fated efforts to make his mackine fly, "the experimenta were resumed, using all avaitable parts of the original markone. The frame and engine were the same as in the first trade the reconstructed wange were used without the leading edge extension, the control minares were econessent that emoderate goal out a bank for a stanot those has were in whitalen or the original. catepost. Those excuped, and weighing over fort percent more I am to 180%, with the min-If fight as an tipe point of super-super-search flown a Banamondspart N Y Japany 1911 With a on the martin, a sguise and fractor prois as I was a sequently flown repented Tapese tests, into ites that the original much bewould have flown in 1900 had it been a receive f lly launched. After the Hammondewet. flights the may one was restored in presenging with the original descrines are casts under the supervision of one of the original must accussoing all original parts as a lable. In it is too man for I is restored was deposited in the had one. Moreonal in the pronuncial excellence

You short months all Europe was a war. Legion more has amplanes a reguler communication was on the air brance and England were raught unprepared. Nowhere in the world had anybody but Glene Cart or exter by the activation a ke Ambiero else was there a factory equipped and ready to turn out planes and motors at high speed.

"The British Government wants you to ler blas the planes you can as fast as you can was the substance of the message tuesmit urbus received through the British Embersy at We at the first metrogen - page

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How Sea Flying Was Made Safe

(Continued from page 142)

"What kind of planes do you want and how much will you pay for them?" he replied.

"Whatever kind of planes you can build at whatever is a fair market price," was the answer, in response to which every other activity of the Curties plants was suspended.

That almost ends the story of Glenn Curtiss as an individual pioneer of the air. From then on it is the story of the Curtiss companies, capitalized by Wall Street financiers, building planes for Great Britain, planes for the United States Army and Navy, merging patents with the Wrights and all the other sieplane builders, at the demand of the United States Governmest, in the patent pool of the Manufacturers' Aircraft Association. It is the story of the cooperative development by the Navy and Glean Curtise of the flying boat into the "N. C." type, one of which, the N. C. 4, a few months after the Armistice, was the first flying craft. to cross the Atlantic.

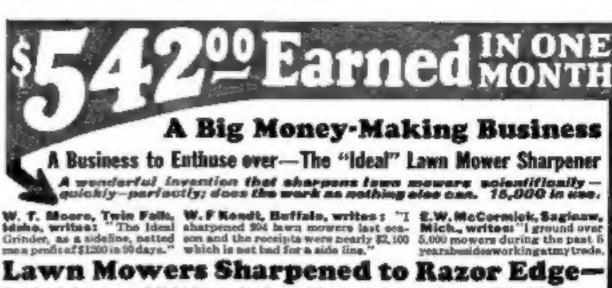
LENN CURTISS today still dreates of Gaviation, although at the moment he is more interested in building new communities in Florids. We sat on the veranda of his rural lodge at the northern edge of the Everglades. There he told me most of what I have set down in these articles.

"We have only just begun to lears how to fig." he said. "This is only 1927; it was less than nineteen years ago that I made my first flight. More has been done in the eight years nince the war ended, toward the real development of aviation, than in the eleven years of flying before that. War called for high power, light weight, great moneuverability-the essentials of stant flying. It put a stop for years to developments looking toward safety, endurance, stability in the air, the essentials of commercial air navigation. Some day," he went on, musingly, "I may start building planes of a different type from any that have yet been constructed. Everybody who has an interest in aviation owes it to himself and to the public to do everything be can to make passenger and freight flying as chenp as milroad transportation, as popular as the automobile, and safer than either.

What Is New This Month

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5 MINUTE VULCANIZER

Here Are Correct Answers to Questions on Page 51

- 1. The harbor of Pago Pago on the island of Tutuila southwest of the Hawanan Islands. The ancient volcano that forms the island sank so that the sea broke into its crater, forming the heautiful barbor now occupied as an American Naval base.
- 2. At the south end of Monterey Ray, California, lies the Monterey Peniasala, on which grow two remarkable species of trees—the Monterey cypress and the Monterey pine. These grow naturally nowhere eise in the world. The twisted weirdly-shaped trees so often seen in pictures of Monterey belong to this strange and vanishing kind of cypress.
- 3. This still is a mystery. Scattered over the eastern half of the United States are roundish followed long mounds, sometimes shaped like serpents, constructed long before the white men came to America. Sesentists believe they were built by the american of the American Indiana.
- 4. Because the Bermuda Islands possess no streams. The roofs are used to collect rain water for water supply, and for sanitary reasons it is necessary that the roofs be kept clean and whitewashed. The water is stored in tunks and cisterns.
- 5. Hecause the peculiar straw cost of which the best grades of Panassa hata are woven, known locally as "paja toquilla," grows in Panassa. The last-making process is a rather complicated one of making and working the straw in addition to weaving.
- On the River Towy, in southwestern Wales, you still can see boats constructed exactly as they were in Rossan times.
- 7. The floating plands of the Nile are really masses of the famous papyrus plant, that supplied the Egyptians with their paper. Matted masses of the plants frequently are torn loose by the current and float as actual plands, large and strong enough to support many men.
- 8. They were gardens built on top of a structure of great arches, such as the arches that support modern stone bridges, because Babylon was very flat and subject to floods. Water for irrigating them was brought up by bucket pumps worked by slaves.
- 9. This used to be a more or less common medicine all over the world. At present, so far as is known, the common use of the monkey ask medicine survives only in Sann, where native doctors consider the askes a valuable remedy for consumption and other diseases of the throat and lungs. Gradually, however, modern medical knowledge is spreading into these comote countries, too.
- 10. Nearly two thirds of the world's supply of the comes from the southern part of the Makey peninsula. Politically this country is under British protection and it known as the Federated Makey States.
- 11. In ascient Babylon more than five thousand years ago the people settled along the banks of the Tigris and Euphrates constructed a great network of irrigation canals, dikes, and storage reservoirs, by which the water of the two rivers was distributed over the plains.
- 12. These two rivers are branches of the Nile, much of where it divides at the city of Khartum. The names refer to the appearance of the water. The White Nile is usually milky from fine rock dust suspended in it. The Blue Nile contains little mud and is clear and blue.